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Value and Acceptability of Increased Wind Power Provision and its Negative Externalities

A contingent valuation study of the willingness-to-pay and the willingness-to-accept of Dutch citizens for the increased production of renewable energy by wind turbines

Master Thesis for the program "Behavioral Economics"

The views stated in this thesis are those of the author and not necessarily those of the supervisor, second assessor, Erasmus School of Economics or Erasmus University Rotterdam.

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Abstract

Increased provision of renewable energy by means of wind power exploitation is at the core of discussions about the energy transition in the Netherlands and other countries globally. The basis of this study is a contingent valuation (CV) survey of a representative sample of 1,166 Dutch citizens. Willingness-to-pay (WTP) estimates for increasing wind energy provision to an additional one million households are elicited. A mean WTP of twelve monthly tax payments of €23.38 each is estimated. 74% to 93% of the people are willing to pay for this increase in wind energy provision, depending on the processing of protest responses. This valuation of benefits faces the valuation of negative externalities that are potentially borne due to the necessary (onshore) wind turbines. Willingness-to-accept (WTA) estimates are obtained from the same sample for having a wind turbine erected within 500 to 1,000 meters from one's home. The mean WTA is estimated to be €23,074. Regression analysis reveals that the main factors affecting WTP and WTA are income and the attitude towards the specific policy. Concerns about climate change are only associated with the WTP. It is shown that the in-principle WTP and WTA decisions (whether to state a valuation of zero or not) have different determinants than the decision about its size with income, for example, not affecting the in-principle decisions but the ones about how much to pay or to be compensated.

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1 Introduction

In recent years concerns about global warming and climate change have experienced increased prominence in political, public, and academic debates. The emission of greenhouse gases, such as carbon dioxide, has been identified as one of the main contributing factors to climate change. The main source of anthropogenic greenhouse gas emission is fossil fuel combustion, mostly undertaken for the purpose of energy production (Höök and Tang, 2013). Therefore, an energy transition away from fossil fuels is at the core of debates about the mitigation of climate change and its effects. The fourth Dutch national environmental policy plan, published in 2001, outlined the ambition to achieve a sustainable energy transition in the Netherlands by 2030. A key component of the outlined pathway is an increase in wind energy production (Kern and Smith, 2008).

However, increasing the production of energy from renewable sources, especially onshore wind, is not only associated with beneficial environmental effects, but also with "[...] a dramatic influence on the landscape and this will require the acceptance of the effected communities." (Ministry of Economic Affairs of the Netherlands, 2016, p. 103). Therefore, the environmental benefits due to increased wind energy production must be put into perspective to its cost to consumers, which also include an environmental degradation component that is mostly, but not exclusively, borne by communities in proximity to wind turbines.

In order to provide more insight into this issue, a representative dataset generated by surveying 1,166 randomly selected Dutch citizens in November 2018 is utilized to assess the Dutch citizens' willingness to pay (WTP) for increased wind energy production and their willingness to accept (WTA) compensation for the potentially borne negative externalities. A mean monthly WTP that is paid as a tax for one year is elicited for realizing a policy that increases wind power provision to an additional one million Dutch households. The elicited WTA represents a one-time payment and aims to financially compensate citizens for having a wind turbine built within 500 meters to 1,000 meters distance from their home. The WTP and WTA were elicited by means of the contingent valuation (CV) method.

Multiple stated preference studies employed the CV method and analyzed individuals' WTP and its determinants for increased renewable energy production and provision in recent years (e.g. Wiser, 2007; Bollino, 2009; Champ and Bishop, 2001; Mozumder, Vásquez, and Marathe, 2011; Zografakis et al., 2010; Koundouri, Kountouris, and Remoundou, 2009; Guo et al., 2014). Also, the WTP for the mitigation of the negative externalities of wind energy production has been studied following the same methodologies (e.g. Krueger, Parsons, and Firestone, 2011; Ladenburg and Dubgaard, 2007; Mirasgedis et al., 2014). Yet studies of the WTA for bearing the negative externalities that arise due to the creation of new renewable energy production capacities are rather scarce (e.g. Groothuis, Groothuis, and Whitehead, 2008). Hence, the current study potentially adds relevant new data to the literature in this field.

Drawing on this literature a variety of possible determinants of the WTP and WTA are identified and examined in regression analyses. A novel approach is being pursued in this analysis, as the decision of whether to state a zero or non-zero WTP (and WTA) and the decision about the size of the stated WTP (and WTA) are modeled separately, since studies such as Liebe, Preisendörfer, and Meyerhoff (2011) suggest that these two decisions are associated with different determinants.

All in all, the aim of this study is twofold: first, the current Dutch citizens' WTP for increased wind energy production and the WTA for bearing the negative externalities of onshore wind turbines are to be estimated. These values generate insights into the valuation of the potential benefits of increased wind power provision and the acceptance of the potential disadvantages of living closely to onshore wind turbines. Putting these values into relation to each other might aid answering questions about the feasibility and compatibility of such policies. Second, it is evaluated if there is support for findings about the determinants of WTP and WTA valuations in this context of previous studies in this current dataset from the Netherlands. Understanding the determinants of the WTP and WTA can support renewable energy policy and investment by identifying characteristics that on average identify proponents and opponents of these policies and factors that could potentially be gainfully targeted to foster the diffusion of renewable energy. Since both valuation measures

were elicited from all participants, an analysis of the determinants of WTP and WTA is enabled individually, but also in comparison between the two measures and the corresponding policies. This holistic assessment of the valuation of two crucial facets of a green energy transition drawing on one sample can be considered rare, if not unique at this point in time.

The paper is organized as follows. First, the most prominent stated preference studies of the last 20 years in the realm of renewable - and especially wind - energy provision and its public perception are reviewed. Also, the CV method in general and elicitation formats are introduced. Then research questions and hypotheses about factors in association with WTA and WTP values are stated based on the previously reviewed literature. After that, the methods and data are described, which is followed by the presentation of the results of the WTP and the WTA elicitation as well as the regression analyses of the determinants of the WTP and WTA. These regression results, the elicited WTP and WTA estimates and their implications are then discussed. Lastly, the limitations of this study due to behavioral aspects involved in eliciting and interpreting WTP and WTA estimates are examined and concluding remarks are formulated.

2 Background

2.1 Contingent valuation and the payment scale format

The CV method is a valuation technique relying on stated preferences of consumers and has found wide application with more than 7,500 publications concerned with this method as of 2012 (Carson, 2012). CV enables obtaining valuations for changes in provision levels of goods that consumers do not routinely trade on markets via direct surveying. A significant share of the studies utilizing the CV method is to be located within the discipline of environmental economics, since environmental economists frequently try to assess the costs and benefits of policies that affect goods such as air quality or biodiversity, which do not have a consumer price generated by supply and demand in a market. The CV method and other stated preference methods enable an ex ante cost-benefit analysis of such policies.

The CV method is employed in surveys to elicit WTP or WTA estimates from individuals for different levels of the provision of some good. Very generally put, participants in these surveys are introduced to the environmental good of interest and a hypothetical policy that influences the provision level of this good[1]. Then participants are asked to state their WTP or WTA to put the proposed policy into practice or avoid it being put into practice. WTP corresponds to the value of realizing a gain or preventing a loss and WTA corresponds to the value of accepting a loss or forgoing a gain (Tunçel and Hammitt, 2014).

Conventional economic theory suggests that the WTA and WTP can be used interchangeably when the same level of gain or loss of a good is valued, since both measures should produce (roughly) the same valuation (Venkatachalam, 2004). However, it has continuously been shown that usually the WTA measure exceeds the WTP measure and this disparity has been analyzed in meta-studies such as Tunçel and Hammitt (2014). The authors of this meta-study briefly present different explanatory approaches that have been employed to explain this disparity but point out that no consensus is reached on the causes of the observed disparity. A concise explanation of the most prominently discussed causes is presented by Venkatachalam (2004). Applying a WTP format is considered the "conservative choice" and is often preferred even when property rights suggest that a WTA format is (in theory) more applicable (Arrow et al., 1993).

The values elicited by the CV method have been shown to be extremely sensitive to the elicitation technique that is employed in a survey (e.g. Bateman et al., 1995; Desvousges, Smith, and Fisher, 1987). Therefore, different elicitation techniques can be expected to yield different estimates of the valuation respondents hold. "The main questionnaire formats used in CV studies are the bidding game (BG[; also referred to as iterated close-ended]), the [single- and double-bounded] dichotomous choice (DC) format, the open-ended (OE) format, and the payment scale (PS[; also referred to as payment card]) format." (Soeteman, van Exel, and Bobinac, 2017, p. 743).

[1] see Mitchell and Carson (1989) for an extensive introduction to the CV method and CV survey design.

All these methods have shortcomings that can broadly be summarized into starting point bias, range bias, item non-response and yea-saying. Evidence has been presented, which suggest that the BG and DC format are liable to inducing starting point bias (Boyle, Bishop, and Welsh, 1985; Holmes and Kramer, 1995) and yea-saying (Kanninen, 1995). The DC and OE format are associated with a large share of non-responses, zero responses and protest responses when compared to the PS format (Reaves, Kramer, and Holmes, 1999; Donaldson, Thomas, and Torgerson, 1997). Non-respondents simply do not (completely) answer the valuation questions. Zero respondents imply a valuation of zero of the good of interest, which might be their authentic valuation of the good and therefore a "real zero" or an expression of their rejection of some aspect of the proposed market scenario if their actual valuation of the change in the provision level of the good is not zero: a "protest zero". A protest response can also be present when a positive valuation is stated, and these are often abnormally high elicited valuations. It is crucial to ask all respondents, especially those who state a zero valuation or an extremely high valuation, for their rationale for doing so to be able to identify protest responses. Despite these advantages of the PS format over the BG, OE and DC format it has also been shown that a range bias can be introduced by the chosen scale (e.g. Whynes, Wolstenholme, and Frew, 2004).

The format applied in this study is a hybrid of the PS format and the OE format and its strength lies in the combination of "[...] the ease of a PS with the precision of an open-ended (OE) format." (Bobinac et al., 2010, p. 1047). To elicit a WTP value in this format the respondents are first asked to choose the highest amount they would certainly want to pay from a payment scale and then the lowest amount they would certainly not want to pay. Finally, the respondents are asked to state their maximum WTP between the two previously selected values[2]. The format will be referred to as the two-stage PS format in the following. Soeteman, van Exel, and Bobinac (2017) show that this format is also liable to inducing range bias, especially for respondents with unstable or not well formed preferences, which can be assumed to be common when not routinely traded goods are to be evaluated. Nonetheless,

[2] The elicitation format will later be presented in detail.

when a carefully designed scale is applied this elicitation format can be argued to be superior to its alternatives.

The values elicited by means of the CV method are object of a long-lasting and ongoing debate about their validity and applicability (e.g. Carson, Flores, and Meade, 2001). The hypothetical values for WTP seem to overestimate the actual WTP, which is often referred to as hypothetical bias (e.g. Arrow et al., 1993; Murphy et al., 2005). Revealed preferences methods on the other hand rely on actual transaction data from a marketplace, such as real estate prices and utilize these to estimate the value of some good, such as undisrupted viewshed, which is especially relevant in evaluating policies in the realm of renewable energy and wind energy provision (e.g. Gibbons, 2015; Heintzelman and Tuttle, 2012). The values estimated by revealed preference studies are often treated as more robust than valuations based on stated preferences, since they are derived from observed decisions in a marketplace rather than stated preferences in a survey.

However, especially in the realm of environmental economics, revealed preference approaches are said to - per definition - not account for the non-use value component of people's valuation of an environmental good. A part of people's valuation of a good such as undisrupted viewshed might not be reflected in real estate prices, since it might not just include the use value of having disrupted viewshed from a property (which is largely captured by real estate prices) but also the non-use value of generally wanting untouched sceneries to be preserved (Hanemann, 1994). Furthermore, a revealed preference approach can only be applied ex post.

2.2 Valuation studies of wind energy and its potentially negative externalities

The research body that is outlined in the following consists of stated preference studies that employ the CV method or choice experiments to elicit WTP estimates for either increased renewable energy production (preferably by wind energy) or the mitigation of the negative externalities arising due to such activities. Additionally, one study using the CV method to elicit WTA estimates for having wind turbines

erected in a scenic region is presented. Lastly, recent revealed preference studies and opinion surveys are briefly discussed. The empirical analysis undertaken in these studies provides a basis for the analysis of the data set at hand, which will be described in detail in later sections. All presented studies have been published in the past 20 years and are comparatively well-cited. This selection, however, is by no means exhaustive[3].

Zografakis et al. (2010) assessed the acceptance and WTP of citizens of the island of Crete (Greece) for the further exploitation of renewable energy sources. The potential for expansion of renewable energy production by different means like wind turbines and photovoltaic parks on Crete was presented, as were the likely environmental and social effects. Participants were asked if they were willing to contribute a monetary sum with their quarterly electricity bill to realize the outlined expansion projects under the assumption that the presented (beneficial) effects would also be realized. Income and considering climate change an important problem were positively associated with the stated WTP as well as the belief in positive economic effects such as job creation, and worrying about Crete's energy supply security. Furthermore, households with high levels of energy saving practices and those who frequently experience electricity shortage on average reported higher WTP estimates. The mean WTP per household was found to be €16.33 quarterly.

Koundouri, Kountouris, and Remoundou (2009) elicited a WTP for a policy that would bring about the building of six wind turbines 1.5 kilometers away from the nearest village on the island of Rhodes (Greece), which would generate energy for approximately 5,000 households (of 37,453 households on Rhodes). Having obtained tertiary education, feeling informed about environmental matters, supporting wind farm installations, and living in a rural area of Rhodes were positively associated with the WTP. Being employed full-time compared to not being employed full-time (controlled for retirement) and the number of children in the household were negatively related with WTP. The elicited mean WTP is €8.86 as a surcharge on

[3] Stigka, Paravantis, and Mihalakakou (2014) present a concise and very general overview of research on the acceptance of renewable energy sources as a substitute for fossil fuels by reviewing CV studies. Additionally, an overview of some regulatory and legislative frameworks in European countries that aim at fostering an increase in renewable energy production is included.

the bimonthly electricity bills.

Wiser (2007) was concerned with participants' WTP for a policy that would hypothetically increase renewable energy production in the US from 2% to 8%, which could be achieved by paying a monthly surcharge on the electricity bill for three years. Results from a regression analysis have been presented that supported that being female and having children is associated with lower likeliness to accept the proposed payment. Furthermore, income, education, expecting others to participate and attitudinal factors such as being liberal appeared to have a significant positive relation with accepting the proposed payment. Special attention was devoted to the effects of presenting participants with different payment vehicles and it was found that the elicited WTP was higher when a mandatory payment mechanism was presented compared to a voluntary one.

Champ and Bishop (2001) assessed the contingent and actual WTP of customers of a big energy provider in the state of Wisconsin (USA) for purchasing wind energy by paying a surcharge on their monthly electricity bill for a year. Respondents were informed that the environmental impact of this would be little, but that it can have signaling effect for the future and other energy providers. The survey was sent out by mail and one group could decide about making an actual purchase of different amounts of wind energy for a year and the other group was asked to answer the same questions, with the only difference being that their purchase was hypothetical. Different attitudinal factors were shown to be determinants of the decision to hypothetically or actually accept the proposed purchase of wind energy, while the effects of these factors were more pronounced for the actually purchasing group. Also, male participants were less likely to accept the proposed transaction than female participants, ceteris paribus. The mean WTP for the hypothetical group was US$101 annually and US$59 annually for the group that made an actual purchase, which is a consistent observation with the before-mentioned discrepancy between hypothetical and actual WTP.

Guo et al. (2014) presented a scenario in which the proportion of total energy consumption satisfied by renewable energy in Beijing province (China) is raised from 3% to 6% over a period of five years and asked participants to accept or reject a

monthly surcharge that all households would pay over this time span to realize the plan. Income, the number of household members and electricity consumption were found to be positively associated with accepting the proposed payment. The average monthly WTP was estimated to be US$2.7 to US$3.3.

Bollino (2009) in 2006 investigated the WTP of Italian citizens to support the development of renewable energy sources in Italy to meet the self-imposed goal of having a share of 22% renewable energy in the energy mix by 2010. Income, education in years of schooling and being a homeowner were found to have a significantly positive relationship with WTP, while female participants on average stated a lower WTP than male respondents. Respondents stated their certainty about paying different amounts and depending on the processing of these responses a mean WTP of €2.44 to €9.39 was obtained (in the form of a surcharge on the bimonthly energy bill).

Mozumder, Vásquez, and Marathe (2011) asked participants how much they are willing to pay in addition to their current monthly electricity bill to increase the share of renewable energy in the energy mix of the state of New Mexico to 10% and 20% (to check for scope sensitivity). Findings support that environmental consciousness, altruism regarding environmental causes (e.g. in the form of donations), income and household size were positively associated with the WTP. Education in years of schooling was negatively related to the WTP in this study, which the author hypothesized to be due to more educated individuals factoring in more negative aspects into their valuation. The mean monthly WTP was estimated to be US$10 for and increase to 10% and US$25 for an increase to 20% renewable energy in the energy mix.

Another stream of stated preference studies has been devoted to estimate WTP values for the mitigation of negative externalities arising due to offshore wind turbines and sheds light on the valuation of disadvantages that can occur due to increasing wind energy production. Krueger, Parsons, and Firestone (2011) and Ladenburg and Dubgaard (2007) ran choice experiments to estimate the WTP for the mitigation of the visual impact of off-shore wind turbines by locating them further away from the shore and found that participants stated that they are willing to pay more when

turbines are sited further off-shore and especially affected residents in coastal areas put high values on the preservation of the scenery. Mirasgedis et al. (2014)[4] used an open-ended CV format to elicit WTP estimates for not hosting onshore wind turbines in Greece close to residential areas. In their study 57 % of participants stated no positive WTP for hosting wind turbines further away from settlements, which might partially be due to the employed OE elicitation format.

A limited number of publications has been devoted to the assessment of the WTA for bearing the negative externalities of the wind turbines that would be necessary to enable increased wind energy production. The only study found with said focus is Groothuis, Groothuis, and Whitehead (2008) who employed the CV method to elicit WTA estimates from residents of a certain area in the USA for hosting wind turbines in their region. Participants were presented with a policy that would entail siting wind turbines on four ridge tops in their area. As compensation the residents' utility bill would be decreased and the appropriate amount for this compensation was elicited to be US$ 23 annually. Income, education and age were not found to be significant determinants of WTA, but attitudinal factors were: expressing a favorable opinion about wind power was related to requiring less compensation and finding wind power harmful to mountain views was associated with higher compensations. Also, participants who retired to the region or have ancestors from the region were on average requiring more compensation.

The contrast between these streams of research make an underlying dispute apparent: Increased renewable energy production and wind energy production is valued and wanted, but this valuation has to be put into perspective with the valuation of the negative externalities arising from the necessary production facilities. It is often found in opinion surveys that "[...] people are in favor of wind power, but are opposed to wind turbines in their own area." (Wolsink, 2000, p. 51), which is often referred to as the NIMBY (Not In My BackYard) syndrome. Carefully designed CV studies can help answering the question of what the perceived proportions are between the benefits and detriments of changes in the provision level of renewable

[4] The authors provide a tabular overview over a selection of studies that quantitatively explore the valuation of negative environmental externalities of wind turbines.

energy and the necessary infrastructure that often comes with negative changes in environmental amenities.

Besides the research body relying on stated preferences, there are also revealed preference studies employing the hedonic approach based on real estate prices to value the negative externalities borne by citizens living in close proximity to wind turbines (e.g. Gibbons, 2015; Heintzelman and Tuttle, 2012). Furthermore, the novel life satisfaction approach has been used to estimate the effect of wind turbines on life satisfaction. Krekel and Zerrahn (2017) used large data set from Germany and found the negative effects of newly erected wind turbines on life satisfaction to be diminishing to zero after five years and that these are generally non-existent at 4,000 meters distance or more. These findings are roughly in line with evidence from opinion surveys that suggested that negative attitudes towards wind farms and opposition decrease post-construction. This does not seem to be the case due to some kind of mere-exposure effect, since the modal reasoning stated for this dissonance between pre- and post-construction attitudes was the non-experience of expected negative externalities (Warren et al., 2005), while an argument for adaption can also be made. However, no such pattern in the attitudes towards wind turbines before and after their construction was found by Ek (2005).

3 Research questions and hypotheses

The data set at hand is explored to fulfill the two aims of this study: first, obtaining WTP and WTA estimates and, second, enabling a better understanding of these estimates. To achieve the first aim, it is asked (1) what the WTP for increased wind energy provision and the WTA for bearing the negative externalities of having a wind turbine erected close to one's home is. To allow for a more differentiated understanding of these values and therefore achieve the second aim of this study three additional questions are asked. (2) What are the determinants of the WTP for increased wind energy production and (3) the determinants of the WTA for bearing the negative externalities of wind turbines? Since the two measure have been elicited from the same sample of Dutch citizens a logical follow-up question is

posed: (4) What insights can be obtained from the comparison and analysis of these determinants and the elicited valuations in these two realms?

Characteristics that are hypothesized to be determinants of the elicited WTP and WTA in this study are based on the before-outlined literature and expectations about the sign of the association between these characteristics and the two valuation measures are formulated below as hypotheses. It is worth noting that these expectations can be considered different in strength, since some are founded on a variety of studies that unequivocally find evidence for their existence and a robust theoretical explanation can be presented, while others concern characteristics that were only analyzed in one study or are seemingly contradicted by findings that have been made in other studies.

Empirical evidence has been presented for a statistically significant relationship between a variety of individual characteristics and the WTP for increased renewable energy provision. Higher income has continuously been found to be a predictor of higher WTP in the presented studies (Wiser, 2007; Guo et al., 2014; Mozumder, Vásquez, and Marathe, 2011), just as a higher level of education (Bollino, 2009; Koundouri, Kountouris, and Remoundou, 2009; Wiser, 2007). Only Mozumder, Vásquez, and Marathe (2011), who utilized a comparatively small sample, found a statistically negative relationship between higher education and WTP. Furthermore, being a homeowner (Bollino, 2009), having positive attitudes towards renewable energy policies (Champ and Bishop, 2001; Koundouri, Kountouris, and Remoundou, 2009), being aware of and concerned about topics such as climate change and global warming (Zografakis et al., 2010) were found to be positively associated with WTP. Also, one study found that living in a rural area was related to a higher WTP (Koundouri, Kountouris, and Remoundou, 2009).

Female participants compared to male participants have been found to state lower WTP in two studies (Bollino, 2009; Wiser, 2007), while no statistically significant effect of gender has been found in most of the publications. Champ and Bishop (2001) found an opposite effect of gender. Having children and the number of children have also been associated with a lower WTP (Koundouri, Kountouris, and Remoundou, 2009; Wiser, 2007), while other studies found a positive effect of house-

hold size. The studies that found a positive effect of household size, however, were small (Mozumder, Vásquez, and Marathe, 2011) or only found a significant association at the 10 percent level (Guo et al., 2014). None of these studies controlled for having children and the household size simultaneously. One study found that being employed full-time compared to not being employed full-time is related to lower WTP (Koundouri, Kountouris, and Remoundou, 2009).

These characteristics and their sign as determinants of WTP are in line with the literature review by Stigka, Paravantis, and Mihalakakou (2014), which employed a different selection of stated preference studies exploring the WTP for policies aimed at fostering the development and usage of renewable energy sources. The authors also reviewed studies that found a negative association between age and WTP, which has not been reported in any of the studies reviewed here.

***Hypotheses about determinants of WTP values**: Income, educational attainment, being concerned about climate change, positive attitudes towards renewable energy polices (especially wind energy policies), being a homeowner, and living in a rural area are positively associated with stated WTP values. Gender (female), being employed full-time, and household size are negatively associated with stated WTP values.*

Groothuis, Groothuis, and Whitehead (2008) is the only study reviewed that was devoted to exploring the determinants of the WTA for bearing the negative externalities of erecting new wind turbines and found that a positive attitude towards wind farms is related to lower WTA while a negative sentiment is associated with a higher WTA. Also, being retired and having ancestors from the region where wind turbines are to be erected were found to be predictive of a higher WTA.

Furthermore, it can be expected that individuals who own the house they live in state higher WTA values since they are explicitly asked to consider the possible depreciation of their property when stating a WTA[5]. Also, the influence of the endowment effect on their stated WTA is likely to be stronger than for participants living in e.g. rental homes (Knetsch, 1990). The endowment effect is one of the fre-

[5] The elicitation process and the presented questions and information will be elaborated on in more detail in the next section.

quently employed concepts in the WTP-WTA-disparity discussion (Venkatachalam, 2004).

***Hypotheses about determinants of WTA**: Negative attitudes towards renewable energy polices (especially wind energy policies), being retired, and owning the house one lives in are associated with higher WTA values. Positive attitudes towards renewable energy polices (especially wind energy policies) are associated with lower WTA values.*

A tabular overview of these hypotheses and the results of the hypothesis testing is given in Table 9 and will be elaborated on in the Discussion section.

4 Data and methods

4.1 Survey administration and design

The data generation took place via an online questionnaire that was sent to 1,166 randomly selected members of the LISS panel (Longitudinal Internet Studies for the Social sciences panel) in November 2018 and was administered by CentERdata (Tilburg University, The Netherlands). The strength of the LISS panel will later be described briefly. 905 individuals finished the questionnaire out of which 893 submitted complete responses to the valuation questions. The response rate was therefore 76.6%. LISS Panel members get a monetary compensation of €15 per hour for filling out surveys. The compensation is paid for the estimated average time required for filling out a questionnaire.

The first part of the questionnaire consisted of questions about the emotional state of the participants in general and their disposition and opinion towards climate change and its consequences. Then questions about a hypothetical policy with the aim of increasing wind energy provision followed and a WTP value for this policy was elicited. Afterwards it was posed that the government intends to build a wind turbine near residential areas (500 meters to 1,000 meters). Then questions about this policy were presented and a WTA value elicited. WTP and WTA values were elicited by the two-stage PS format outlined before and respondents were asked to

give insights on their rationale for their responses to the valuation questions. The final part of the survey was concerned with socio-demographic data.

The elicited WTP values correspond to a monthly tax that all Dutch citizens would pay for twelve months to financially support the construction of the necessary production capacities and infrastructure to satisfy the energy demand of one million additional households in the Netherlands with wind energy. The payment mechanism of a tax is tangible and probably familiar to most participants. Also, mandatory payment mechanism such as taxes mitigate the potential for strategic responses in CV surveys (Carson, Flores, and Meade, 2001). Participants were presented with the scale [€0; €5; €10; €15; €20; €25; €30; €40; €50; €75; €100; more.] and first asked to choose the highest amount they would certainly want to pay and then the lowest amount they would certainly not want to pay before they could state the value closest to their maximum WTP within the interval created by the foregone choices.

Participants who selected "more" in the first step could indicate an amount in an open-ended question that represents their perceived maximum WTP. These amounts outside the scale were checked considering the net income of the participant and the stated rationale for the response and, if deemed appropriate, identified as protest responses. Participants who chose €0 in the first step were asked about the reason for this answer. They had the option to select (1) it is not worth more than €0 to me, (2) I cannot pay more than €0, (3) the government has to pay for this or (4) other, which allowed them to type an individual answer. The first option is considered to identify a true zero, while the second and the third option identify a protest zero. Answers from the last option were individually evaluated. Participants were continuously reminded to take the net income and current savings of their household into account.

The WTA value aims at capturing the compensation a participant would want to get if a wind turbine is erected within 500 meters to 1,000 meters from their home by the government. Participants were informed that wind turbines can cause noise pollution and that some people consider them to have a disadvantageous visual impact. Furthermore, participants were reminded that, if they own a home, this

proximity to a wind turbine can cause a depreciation of up to five percent of the real estate value. The results of Gibbons (2015) in his revealed preference study relying on real estate prices in the UK between 2000 and 2012 suggest that this percentage of price depreciation is not unrealistic. He finds a housing price reduction of five to six percent for residential properties within two kilometers of a visible wind farm as an average price reduction over all sizes of wind farms. This effect is sensitive to the size of the wind farm. Since the scenario in this study only encompasses one wind turbine being built rather close to one's property, five percent can be argued to be a reasonably realistic value.

Following the same elicitation format as for the WTP, participants were presented with the scale [€0; €5,000; €10,000; €15,000; €20,000; €25,000; €30,000; €40,000; €50,000] and first asked to choose the highest amount they would certainly not accept and then the lowest amount they would certainly accept as a compensation before they were asked to state the amount closest to their minimum WTA within the created interval. If participants selected €50,000 in the first step, then they could indicate their minimum WTA in an open-ended question immediately and were asked if they felt that there is no amount that could compensate them in a dichotomous question. Analogously to the WTP estimation, participants who chose €0 in the first step were asked to state the rationale for this answer: (1) I have no objection to a wind turbine near my home, (2) I do not expect any effects from a wind turbine in 500 to 1,000 meters distance from my home, (3) I disagree with paying compensation and (4) other, which allowed them to formulate an individual answer. The first two options characterize a true zero, the third option a protest zero and answers of the "other"-option were individually evaluated. The original phrasing of the valuation questions can be found in the Appendices.

4.2 Data characteristics

Descriptive analysis and regression analysis were carried out with the software STATA 15.1. Descriptive statistics about the pool of participants are displayed in Table 1. It is noteworthy that individuals below the age of 16 are not represented in the sample. A consequence of this is that the pool of participants has a higher median age than the Dutch population (43.3 compared to 55 in the sample) and that the share of retirees in the sample is larger than in the national population.

Variables	N	mean	SD	min	max
Age (years)	893	52.40	18.40	16	91
Monthly net household income (€)	818	3,203	1,696	0	11,650
No. of household members	893	2.469	1.296	1	8
Living (married) with a partner (1=yes)	893	0.708	0.455	0	1
Children (1=yes)	893	0.351	0.477	0	1
Occupation					
Retired (1=yes)	892	0.258	0.438	0	1
Employed[a](1=yes)	892	0.479	0.500	0	1
Own home[b](1=yes)	891	0.724	0.447	0	1
Gender (1=female)	893	0.542	0.499	0	1
Education					
High education[c](1=yes)	893	0.361	0.480	0	1
Medium education[d](1=yes)	893	0.355	0.479	0	1
Concerned about climate change[e](1=yes)	844	0.409	0.492	0	1
Living in an urban area[f](1=yes)	893	0.545	0.498	0	1

[a] Participants have paid work (employed or self-employed) or work in a family business.
[b] Participants live in a household that owns their home.
[c] Participants have completed WO or HBO education.
[d] Participants have completed MBO or HAVO/VWO education
[e] Participants responded that they are very much or quite a lot concerned about climate change and global warming.
[f] Participants live in an area with 1,000 or more addresses per km^2.

Table 1: Descriptive statistics

Table 2 and Table 3 summarize the responses to the attitudinal questions that were asked directly before the WTP and WTA were elicited from respondents. It becomes apparent that the scenario related to the WTP elicitation was regarded more favorably by the participants since 670 of the 893 respondents answered that they were strongly in favor or in favor of the policy that increases wind energy provision in the Netherlands, while only 291 respondents gave responses in the same

categories when asked about the second policy, which entails the erection of wind turbines close to residential homes. Responses to the two attitudinal questions are moderately associated (Cramer's V = 0.355[6]).

Response \ Question	"Suppose the government wants to invest in wind turbines to allow one million extra households in the Netherlands to use green energy. What do you think about this?"
I am strongly in favor	230 (25.76%)
I am in favor	440 (49.27%)
I am against it	57 (6.38%)
I am strongly against it	35 (3.92%)
No opinion	131 (14.67%)
	893 (100.00%)

Table 2: Participants' attitudes about the presented WTP scenario

Response \ Question	"Suppose that the government intends to build wind turbines close to the users, because then the least energy is lost in transporting the energy to the user. Instead of in large wind farms, wind turbines will be built close to (500 to 1,000 meters) residential areas. What do you think about this?"
I am strongly in favor	40 (4.48%)
I am in favor	251 (28.11%)
I am against it	261 (29.23%)
I am strongly against it	171 (19.15%)
No opinion	170 (19.04%)
	893 (100.00%)

Table 3: Participants' attitudes about the presented WTA scenario

Cross-tabulation of the responses reveals that 296 out of the 670 respondents who expressed a favorable attitude towards the first policy expressed that they are against or strongly against the second policy. Therefore, almost half of the

[6] Cramer's V is a measure of strength of association for nonparametric statistics and takes a value from 0 to 1. Interpretation: 0.0 - 0.1 negligible association; 0.1 - 0.2 weak association; 0.2 - 0.4 moderate association; 0.4 - 0.6 relatively strong association; 0.6 - 0.8 strong association; 0.8 - 1.0 very strong association (Rea and Parker, 2014).

proponents of investments in wind turbines to supply one million extra households in the Netherlands with renewable energy are opponents to new wind turbines being erected close to their residential area. This hints at the widespread existence of a NIMBY attitude towards the production of wind energy, which can be regarded an impediment to a further diffusion of this means of renewable energy production. However, research has been conducted that supports the claim that other factors than NIMBY attitudes are greater barriers to the development of new wind energy capacities and that the role of public acceptance is often overstated when planning practices are not being considered (Wolsink, 2000), which, however, are not an object of this study. All 291 respondents who stated to be in favor or strongly in favor of the erection of wind turbines close to residential areas, on the other hand, stated to be in favor or strongly in favor of increased wind energy provision in general, except for 4 participants who stated to have no opinion.

4.3 Zero responses, outliers, and protest responses

Table 4 concisely summarizes the number of responses that are deemed valid responses, valid zero responses and protest responses to each of the two valuation questions. In the following it is described in more detail how the identification process was carried out.

Out of 893 participants who completed the questionnaire, 222 stated a WTP of zero and six stated a WTP positively outside the scale. Of the participants who indicated a WTP of zero, 92 (41.4%) chose the predefined rationale "The Government should pay", while 23 (10.4%) chose "I cannot pay more", 43 (19.4%) chose "It is not worth more to me" and 64 (28.8%) chose "other". Out of the 64 individuals who chose "other" all but seven, which were closer to a "not worth it" response, were labeled protest responses. The 43 "not worth it"-responses and the seven responses from the "other" category constitute the responses that are treated as real zero valuations. The remaining 172 zero responses are treated as protest responses since they do not appear to reflect a valuation of the effects of the presented policy. Out of the six responses that exceeded the scale four are considered true valuations since respondents laid out that they consider the energy transition to be of utmost impor-

tance and since socio-economic data and responses to attitudinal questions seemed to be consistent with this valuation. Two of these respondents stated a WTP of €125, one stated €200 and one stated €250 per month. The other two respondents seemed to have chosen the values out of cynicism or due to problems with filling out the questionnaire and were labeled as protest responses: one respondent stated a WTP of €400 with the rationale "because they simply waste a lot of money"[7] and the other a WTP of €50 instead of one outside the scale without providing a further open-text response.

When comparing individuals who expressed a protest response for the WTP measure to those who did not, income appears to be significantly lower ($p < 0.0001$), the share of individuals who obtained a degree of higher education (WO or HBO) seems to be significantly lower ($p < 0.0001$) and the share of individuals who stated that they are concerned about climate change and global warming was significantly lower ($p = 0.0003$). One-sided t-tests corrected for unequal variances were carried out.

	N	elicited values (true zeros[a])	protest responses[b]
WTP	893	719 (50)	174
WTA	893	592 (67)	301

[a] Participants who indicated a true valuation of zero. These 50 respondents are also included in the 719 valid responses.
[b] Participants who imply that they reject the proposed policy and don't express a true valuation.

Table 4: True, zero and protest WTP and WTA responses

Out of the 893 participants who answered the WTA questions, 198 stated a WTA of zero while 170 indicated a WTA that exceeds the presented scale. Out of those who stated a WTA of zero, 24 (12.1%) chose "I do not expect any effects from a wind turbine", 43 (21.7%) chose "I have no objection to a wind turbine close to my home", 78 (39.4%) chose "I disagree with paying compensation" and 53 (26.8%) chose "other". The former two rationales are seen to identify a true zero, while "I disagree with paying compensation" identifies protest zeros. The respondents who chose "other" were individually evaluated but seem to all express

[7] originally: "omdat ze nou eenmaal veel geld verspillen"

protest. Therefore, 67 true zeros were identified and 131 protest zeros. Out of the 170 participants that indicated that their minimum WTA exceeds the presented scale 108 indicated that no amount is adequate to compensate them, which were labeled protest responses. 13 of the 62 respondents who could indicate a WTA outside the presented scale entered a logically inconsistent responses (lower than €50,000) and are considered protest responses. The remaining 49 observations (mean: €238,469.4, median: €100,000, mode: €100,000, min: €60,000, max: €5,000,000) were also labeled protest responses. If a rationale would have been laid out in the open text question that seems consistent with a valuation that (greatly) exceeds the presented scale and does not appear to convey cynicism, protest or simply rent seeking then the response is considered a true valuation. However, this was not the case for any of the 49 responses. It cannot be completely ruled out that some participants expect a substantial decrease in living quality, environmental amenities and/or live in a very valuable real estate, which could validate such a high WTA. However, no data on the value of the participants real estate possession is available and, additionally, many of these 49 respondents stated rather clear protest against the policy (e.g. "Would Rutte want it in his backyard. What do you think."[8] corresponding to a €200,000 WTA).

On the basis of a one-sided t-test (corrected for unequal variances) it is held that among individuals who express a WTA compared to those who express a protest response income is significantly higher ($p = 0.0025$) and that the share of individuals stating that they are concerned with global warming and climate change is significantly higher ($p = 0.0199$). The share of individuals who obtained a degree of higher education (WO or HBO) seems to be equal in both populations ($p = 0.1318$).

Stating a protest response in one of the valuation questions is mildly correlated to stating a protest response in the other ($r^9 = 0.2832$) and 106 out of the 893 respondents gave a protest response to both valuation questions according to the classification of protest responses described above. Protest responses are not included in the following regression analysis and the calculation of WTP and WTA

[8] originally: "Zou Rutte hem in zijn achtertuin willen. Wat denk u."

[9] "r" represents Pearson's correlation coefficient or Pearson's Phi in the case of two dichotomous variables.

estimates if not explicitly stated otherwise.

4.4 Methods

In the regression analysis following in the next section a two-step approach will be applied to analyze the determinants of WTP and WTA. For simplicity, the concept is explained on the example of a WTP elicitation. Drawing from Liebe, Preisendörfer, and Meyerhoff (2011) there is support for the gainfulness of understanding and analyzing the elicitation process CV study participants undergo as a two-step decision process: First, participants decide if they pay at all ("in-principle WTP"), which can be understood as a binary decision. Second, given they decide to state a positive WTP they must decide on a positive value ("size of WTP"). The first decision and its determinants will be analyzed using a logistical regression (logit) model and the second decision will be analyzed using an Ordinary Least Squares (OLS) regression.

Descriptive statistics about the dependent variables are documented in Table 4 and Table 5 that were discussed before. No hypotheses about the determinants of in-principle WTP and WTA have been formulated due to a lack of studies that are concerned with the same matter that apply this method. Nonetheless, Liebe, Preisendörfer, and Meyerhoff (2011) were concerned with public environmental goods and found that income had a significant positive association with the stated amount of WTP, but was not significantly associated with the decision of whether or not to pay at all. Insights of this kind arising from the comparison of the role that a characteristic seems to play in different decisions are the desired result.

4.4.1 Independent variables

Based on the empirical results of previous studies in this realm, which were outlined before in the Background, independent variables that are hypothesized to be determinants of the elicited WTP and WTA values were constructed and are described concisely in the following as are general control variables. Descriptive statistics are available in Table 1, Table 2 and Table 3.

Age in number of years and a dummy variable for *Gender*, which takes the value 1

for female participants and 0 otherwise, are included. *number of household members* is included as a discrete variable. Other possible variables that yield information about household composition such as number of children (r = 0.9144) or a dummy variable for if children are living in the household (r = 0.8120) are highly correlated with number of household members. Since number of household members is a more inclusive metric than the other two and to avoid problems of multicollinearity, only a variable for the number of household members is included.

Educational attainment is categorized and represented by dummy variables with the lowest category as the reference category. *High education* takes the value 1 if the highest educational degree the participant obtained is a HBO or WO degree. *Medium education* takes the value 1 when the highest educational degree the participant obtained is a MBO or HAVO/VWO degree. The occupational dummy variable *Retired* simply encompasses all participants who stated to be retired while *Employed* identifies all participants who are (salaried) employed, self-employed or work in a family business. The base category for the occupational dummies is constituted of those who are neither employed, nor retired, which can for example be students or housekeepers.

Own home takes the value 1 if the participant states that the household owns the property it resides in. *Urban* takes the value 1 if participants live in an area with 1,000 or more addresses per km^2 and 0 otherwise. According to the Centraal Bureau voor de Statistiek (2019) areas with 1,000 or more addresses per km^2 are considered moderately urban.

Concerned about climate change aims to capture awareness of and concern about climate change and global warming. The variable takes the value 1 if participants state that are "very much" or "quite a lot" worried about climate change and global warming, compared to 0 if participants state that they are "a little bit" or "not at all" concerned about these topics.

Additionally, there are two categorical variables capturing the participants attitude towards the proposed policies in general. These variables are coded as dummy variables and *Attitude WTP* will be included in regressions with the dependent variable being some form of the WTP and *Attitude WTA* will be included in the

regressions concerned with WTA. Participants could choose a category best representing their attitude towards the presented policies, which were: "I am strongly in favor", "I am in favor", "I am against it", "I am strongly against it" and "No opinion". The reference category is in both cases the "No opinion" category and a the dummy variable *In favor* takes the value 1 for respondents who chose one of the two favorable categories and the dummy variable *Against* takes the value 1 for respondents who chose one of the two categories expressing opposition. The exact phrasing of these questions about participants' attitudes and the answer frequencies can be inferred from Table 2 and Table 3.

4.4.2 Models

The determinants of the binary decision to either state a zero or non-zero value for the WTP and WTA is analyzed utilizing a logit regression model containing the before described variables, which will be estimated in the following. Equation 1 shows the model for estimating the probability of stating a zero WTP and Equation 2 of stating a zero WTA. X is a vector of individual characteristics.

$$\Pr(\text{WTP} = 0 \mid \text{X}) = \frac{\exp(\beta_0 + \beta_1 \text{Log(net Income)} + \beta_2 \text{Age} + ...\beta_{13} \text{Attitude WTP (cat. 4)})}{1 + \exp(\beta_0 + \beta_1 \text{Log(net Income)} + \beta_2 \text{Age} + ...\beta_{13} \text{Attitude WTP (cat. 4)})} \tag{1}$$

$$\Pr(\text{WTA} = 0 \mid \text{X}) = \frac{\exp(\beta_0 + \beta_1 \text{Log(net Income)} + \beta_2 \text{Age} + ...\beta_{13} \text{Attitude WTA (cat. 4)})}{1 + \exp(\beta_0 + \beta_1 \text{Log(net Income)} + \beta_2 \text{Age} + ...\beta_{13} \text{Attitude WTA (cat. 4)})} \tag{2}$$

In the next step the determinants of a stated WTP and WTA that are non-zero are being analyzed employing OLS regression models. The population models that will be estimated are stated below in Equation 3 and Equation 4. The dependent variables are the logarithms of the WTP and the WTA since preliminary models that were estimated with the elicited WTP and WTA in levels appeared to have an unsuitable functional form on the basis of a Ramsey RESET test. The models below appeared well-specified at least according to this criterion. This matter will briefly be picked up when the results are discussed.

$$log(WTP) = \beta_0 + \beta_1 \text{Log(net Income)} + \beta_2 \text{Age} + ... \beta_{13} \text{Attitude WTP (Against)} + \epsilon \quad (3)$$

$$log(WTA) = \beta_0 + \beta_1 \text{Log(net Income)} + \beta_2 \text{Age} + ... \beta_{13} \text{Attitude WTA (Against)} + \epsilon \quad (4)$$

5 Results

The results presented in the following serve to fulfill the two before formulated aims of this study. First, the results of the elicitation of the WTP and the WTA values are described, which serves to answer what the WTP for increased wind energy provision and the WTA for bearing the negative externalities of having a wind turbine close to one's home are. Second, regression results will be presented to answer the research questions about what the determinants of the elicited WTP and WTA are and to allow for a better understanding of the obtained values. Statistically significant associations are identified with the conventional significance levels of 1, 5 and 10 percent, whereas the last of these levels is considered to only identify weak significance and is treated cautiously.

5.1 Elicited values for WTP and WTA

Table 5 and Table 6 present statistics on the elicited WTP and WTA values.

The mean monthly WTP after excluding the before-described protest responses is €23.38 with a median of €18.00. The SD, the minimum and the maximum highlight a great heterogeneity in the stated monthly WTP by survey participants. Protest responses can be included in the estimation of statistics about the elicited WTP values in the following way: If all 174 responses that were labeled as protest responses were recoded to represent a stated monthly WTP of zero, as suggested by Halstead, Luloff, and Stevens (1992), then the mean monthly WTP would be €18.83 and the median monthly WTP is €15.00. It can tentatively be assumed that a referendum that presents the WTP scenario and policy stated in this survey

at a monthly tax of below €15.00 per household (for one year) would gain a simple majority. This methodology for including protest responses is rather conservative since it does not allow for positive valuations among the protest respondents, which is likely to introduce a downward bias in the mean and median WTP.

If only the positive WTP valuations are considered and protest responses are excluded, then a mean monthly WTP of €25.13 with a median monthly WTP of €20.00 is obtained. When the elicited values are organized by the attitude towards the policy then participants who expressed one of the two favorable attitudes towards the proposed scenario stated a mean monthly WTP of €25.71, whereas participants who chose one of the two response categories expressing opposition stated a mean monthly WTP of €8.86. Respondents who chose "No opinion" stated a mean monthly WTP of €15.44. Response frequencies can be inferred from Table 2.

	Mean	SD	Median	min	max	N
WTP	€23.38	€21.95	€18.00	€0	€250	719
WTA	€23,074	€14,978	€22,500	€0	€50,000	592

Table 5: WTP and WTA estimates excluding protest responses

The mean WTA excluding protest responses amounts to €23,074 with a median of €22,500. Here again the stated values are quite heterogeneous and it has to be noted that the number of positive outliers that were excluded as protest responses is higher than for the WTP measure, which at least raises the suspicion that the true mean and median WTA could be significantly higher than the values displayed here. Analogous to the methodology of including protest responses in the WTP estimation, a conservative approximation of statistics of the stated WTA including protest responses is carried out. If all 301 protest responses are recoded to represent the maximum valuation on the presented scale (€50,000) then the mean WTA is €32,150 with a median of €35,000.

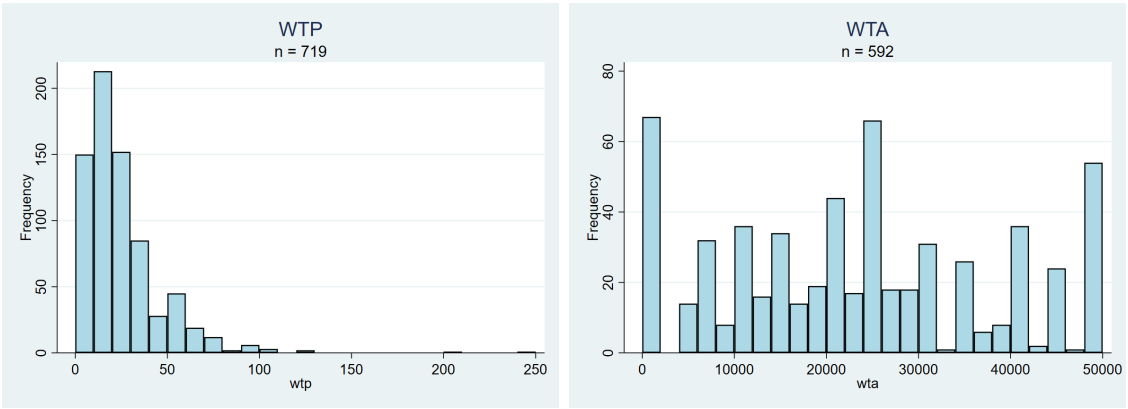
When only positive WTA valuations are considered and protest responses are excluded then a mean WTA of €26,018 is obtained with a median WTA of €25,000. If mean WTA is calculated by attitudes, then respondents who chose one of the two

favorable attitudes towards the proposed scenario stated a mean WTA of €19,254, while participants who chose one of the two response categories expressing opposition stated a mean WTA of €29,611. Respondents who chose "No opinion" stated a mean WTA of €18,722. Frequencies are presented in Table 3.

	No opinion (SD)	Against (SD)	In favor (SD)
WTP	€15.44 (€14.66)	€8.86 (€15.80)	€25.71 (€22.52)
WTA	€18,722 (€14,183)	€29,611 (€13,754)	€19,254 (€14,457)

Table 6: WTP and WTA estimates by attitude towards respective policy

Figure 1 shows the distribution of the elicited WTA and WTP values in frequencies excluding protest responses. The distribution of the elicited WTP is centered around the mean and is skewed to the right. The distribution of the elicited WTA values on the other hand is more evenly spread over the range of the scale with the highest frequencies being present at the low bound, the high bound and the center of the payment scale. It should be noted that the WTA data shown in the histogram is practically censored at €50,000 since no true valuations above this value could unambiguously be identified.



(a) WTP (b) WTA

Figure 1: Histograms of WTP and WTA frequencies (excluding protest responses)

5.2 Determinants of stating a zero WTP and WTA

The estimation results of the two before-described logit models are presented in Table 7. The reported standard errors are heteroskedasticity-robust.

To allow for some certainty about the quality of the specification of the models a link test was carried out. The link test is based on the work of Tukey (1949) and Pregibon (1979) and is a standard specification test for single equation models in STATA 15.1. In both cases the squared predicted values seem to yield no predictive power, which implies that there is no problem of misspecification in either of the two models according to this criterion.

The number of observations that could be utilized in both models are below the numbers of valid WTA and WTP responses shown in Table 4, which are 719 for WTP and 592 for WTA. Questions about (household) income, concern about climate change and global warming, owning a home and occupation were partially not answered, which led to a usable data set consisting of 639 observations for the first estimated model and 526 for the second estimated model. The 80 respondents who stated a valid WTP but could not be included in the the regression stated a mean monthly WTP of €20.58 with a median of €16.50 and a SD of €18.47, while 10 out of these 80 respondents stated a (true) zero WTP. The 66 respondents who stated a valid WTA but could not be used for the estimation of the model stated a mean WTA of €21,726 with a median of €20,500 and a SD of €16,541 with 13 out of these 66 stating a WTA of zero.

First, the results from estimating the model with the dependent variable being stating a WTP of zero are described. Being female compared to being male significantly lowers the estimated probability of stating a WTP of zero, ceteris paribus. An additional household member as well as being concerned about climate change compared to not being concerned about climate change increases the estimated probability of stating a zero WTP, all other things equal. Being in favor of the proposed policy decreases the estimated probability to state a zero WTP, while stating to be against the proposed policy increases this estimated probability, ceteris paribus. The reference category is stating to have no opinion towards the policy. Education, the type of occupation one has, income, age, living in an urban area, and living in

	(1) zeroWTP			(2) zeroWTA		
VARIABLES	Coefficient	SE	P-Value	Coefficient	SE	P-Value
Log(net household income)	-0.04	(0.50)	0.93	0.06	(0.36)	0.87
Age	0.01	(0.01)	0.41	0.01	(0.01)	0.51
Urban (1=yes)	0.52	(0.46)	0.26	-0.46	(0.35)	0.18
Gender (1=female)	-0.99**	(0.42)	0.02	-0.41	(0.30)	0.17
No. of household members	0.36**	(0.18)	0.05	-0.04	(0.14)	0.81
Education[a]						
Medium education	-0.06	(0.65)	0.93	0.11	(0.39)	0.78
High education	0.09	(0.62)	0.89	-0.42	(0.47)	0.37
Own home (1=yes)	-0.61	(0.56)	0.28	-0.93***	(0.34)	0.01
Occupation[b]						
Employed	-0.48	(0.63)	0.45	-0.29	(0.39)	0.46
Retired	-0.15	(0.78)	0.84	-0.36	(0.53)	0.50
Concerned climate (1=yes)	-0.99**	(0.50)	0.05	-0.17	(0.32)	0.60
Attitude WTP[c]						
In favor	-2.44***	(0.56)	0.00			
Against	1.51***	(0.55)	0.01			
Attitude WTA[d]						
In favor				0.07	(0.39)	0.86
Against				-1.25**	(0.50)	0.01
Constant	-1.67	(3.83)	0.66	-1.16	(2.51)	0.64
Observations	639			526		
(McFadden's) Pseudo R^2	0.370			0.095		
Adjusted Count R^2	0.050			0.000		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[a] Reference category is the lowest education category. *Medium education* encompasses MBO and HAVO/VMBO degree holders and *High education* WO and HBO degree holders.
[b] Reference category are unretired participants who are not employed.
[c] Reference category is stating to have "No opinion".
[d] Reference category is stating to have "No opinion".

Table 7: Estimation results of logit regression models excluding protest responses

an a house one owns seem to not have significant associations with the probability of stating a WTP of zero.

Second, the results from the model concerned with the probability of stating a WTA of zero are presented. Owning the property one resides in compared to not owning it significantly decreases the probability of stating a WTA of zero, ceteris

paribus. Also, stating to be against the proposed policy compared to stating to have no opinion, all other things equal, significantly decreases the estimated probability of stating a WTA of zero. All other estimated coefficients of the independent variables are not statistically significant on any conventional significance level.

The reported goodness-of-fit measures imply substantial differences in model fit between the two estimated models. The first model seems to fit the data quite well and is an improvement over a model that just statically predicts the most frequent outcome (in this case having non-zero WTP), which can be inferred from the positive adjusted Count R^2. The second model on the other hand has a comparatively low McFadden's R^2 and is not an improvement over a static model that simply predicts a non-zero WTA for every combination of characteristics.

As a robustness check the models were also estimated including all protest responses. A WTP protest response was coded as a zero WTP and a WTA protest response was coded as a non-zero WTA. The regression outputs can be found in the Appendices in Table 10. Due to the before-described disparities such as lower income and less climate concern among WTP protest respondents, some associations appeared to be significant that did not before. Nonetheless, the classification of all protest respondents into one category has to be considered rather insensitive and the main observation here is that the associations that appeared significant when protest respondents were excluded still appeared significant in both models when protest respondents were included in the way described above.

5.3 Determinants of size of WTP and WTA

The estimation results of the two before-described OLS models are presented in Table 8. The reported standard errors are heteroskedasticity-robust.

To allow for some insight on the quality of the models' functional forms a Ramsey regression specification-error test for omitted variables was carried out and for both models the null hypothesis that there are no omitted non-linear variables cannot be rejected on a 10% level. The p-value is 0.2547 for the first model and 0.7065 for the second model. However, it should be noted that this test is not a general specification test and does not aid answering the question if there are linear omitted

variables (Wooldridge, 2016).

Again, the number of observations used in both models is below the number of valid WTP and WTA responses excluding zero responses presented in Table 4 due to partially missing data on income, concern about climate change, owning a home and occupation. The first model is estimated on the basis of 599 observations while there are 669 valid, non-zero WTP responses and the second model is estimated on the basis of 472 observations while there are 525 valid, non-zero WTA responses. The 70 observations with a valid, non-zero WTP, which could not be included in the model have a mean monthly WTP of €23.51 with a median of €20.00 and a SD of €17.90. The 53 respondents, who stated a valid, non-zero WTA and were not included in the model stated a mean WTA of €27,055 with a median of €25,000 and a SD of €13,966.

First, the results of the model concerned with explaining the logarithm of positive WTP responses is considered. If the monthly net household income increases by one percent the stated WTP is estimated to increase by 0.28 percent, ceteris paribus. Being female compared to being male decreases the estimated WTP by 13 percent, all other things equal. Stating to be concerned about climate change compared to stating to be not be concerned about these matters increases the estimated WTP by 20 percent, ceteris paribus.

Expressing to be in favor of the policy compared to having no opinion increases the WTP by 40 percent, ceteris paribus, while expressing opposition does not appear to be significantly related to stating a higher or lower WTP. Lastly, an additional household member decreases the estimated size of WTP by 6 percent, all other things equal. This relationship, however, seems less pronounced and can only be considered significant on a 10 percent significance level. Education, the type of occupation one has, age, urbanity of living area and living in a property one owns seem to not have significant associations with the stated WTP and the estimated coefficients (and, therefore, their marginal effects) appear rather small in comparison to the before mentioned coefficients.

Second, the results of the model estimating the logarithm of the stated WTA are described (Table 8). A one percent increase in the net monthly household income is

	(3) Log(WTP)			(4) Log(WTA)		
VARIABLES	Coefficient	SE	P-Value	Coefficient	SE	P-Value
Log(net household income)	0.28***	(0.07)	0.00	0.16***	(0.06)	0.01
Age	-0.00	(0.00)	0.16	0.00	(0.00)	0.21
Urban (1=yes)	0.08	(0.06)	0.17	0.08	(0.05)	0.12
Gender (1=female)	-0.13**	(0.06)	0.03	0.04	(0.05)	0.51
No. of household members	-0.06*	(0.03)	0.05	0.01	(0.02)	0.76
Education[a]						
Medium education	-0.08	(0.08)	0.32	0.14*	(0.08)	0.07
High education	0.06	(0.08)	0.47	0.12	(0.08)	0.13
Own home	0.05	(0.07)	0.45	0.07	(0.07)	0.32
Occupation[b]						
Employed	-0.03	(0.07)	0.67	0.07	(0.07)	0.32
Retired	-0.01	(0.10)	0.95	-0.07	(0.10)	0.48
Concerned climate (1=yes)	0.20***	(0.06)	0.00	-0.08	(0.05)	0.14
Attitude WTP[c]						
In favor	0.40***	(0.11)	0.00			
Against	0.05	(0.18)	0.80			
Attitude WTA[d]						
In favor				-0.10	(0.09)	0.25
Against				0.25***	(0.09)	0.00
Constant	0.60	(0.50)	0.23	8.27***	(0.47)	0.00
Observations	599			472		
R^2	0.121			0.147		
Adjusted R^2	0.102			0.123		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[a] Reference category is the lowest education category. *Medium education* encompasses MBO and HAVO/VMBO degree holders and *High education* WO and HBO degree holders.
[b] Reference category are unretired participants who are not employed.
[c] Reference category is stating to have "No opinion".
[d] Reference category is stating to have "No opinion".

Table 8: Estimation results of OLS regression models excluding protest responses

estimated to increase the stated WTA by 0.16 percent, ceteris paribus. Also, being against the proposed policy compared to having no opinion increases the WTA by 25 percent, ceteris paribus, while being in favor of the policy does not produce a significant coefficient. Having obtained medium education compared to having low education is associated with a 14 percent increase in WTA, all other things equal,

yet this association is only significant on a 10 percent significance level. All other variables do not generate significant coefficients in this estimation.

According to the reported goodness-of-fit measures the second model explains more variation in its dependent variable than the first one. Additionally, it should be noted that a Shapiro-Wilk test for normality on the residuals of the second model with the logarithm of the elicited WTA values as dependent variable does not provide evidence for assuming that the residuals are normally distributed (p-value < 0.00001). Hence, the confidence intervals and p-values of the estimated coefficients need to be treated with caution. The residuals of the first estimated model seem to be normally distributed according to the Shapiro-Wilk test (p-value $= 0.22518$).

6 Discussion

The two aims of this study were, first, to obtain WTP and WTA estimates and, second, allow for a differentiated understanding of these estimates by analyzing the determinants of the elicited WTP and WTA values. The first aim can largely be regarded fulfilled due to the before presented results of the WTP and WTA elicitations. The second aim is now further pursued by critically assessing, comparing, and analyzing the before presented regression results.

In the following it will be assessed if the hypotheses that have been formulated based on empirical results from previous, comparable studies proved to be valid in application to the data set at hand. Furthermore, the results from the two-stage regressions will be discussed in more detail and noteworthy findings highlighted to further answer the research questions of what can be learned about the determinants of the elicited WTP and WTA values and what implications can be derived from the analysis and comparison of these determinants. Additionally, the elicited WTP and WTA estimates will be put into relation to better understand in how far a policy that aims at increasing renewable energy provision by means of new onshore wind turbines is feasible under the assumption that wind turbines will be erected close to residential areas to maximize energy transport efficiency.

6.1 Discussion of hypotheses and regression results

Table 9 summarizes the before-formulated hypotheses and if they can tentatively be accepted or rejected on the basis of the regression results. Numerous hypotheses proved valid, such as the ones about income, concern about climate change and attitudes. Nonetheless, some hypotheses cannot be accepted, which is perhaps unsurprising for those that were only founded on one, by chance small, previous study.

The hypothesis about education, on the other hand, was formulated due educational attainment frequently being presented to be a significant determinant of WTP in this realm by studies such as Wiser (2007), Bollino (2009), and Koundouri, Kountouris, and Remoundou (2009). All these studies controlled for income. In this case, however, both education category dummies proved insignificant and their joint influence on the size of the WTP also appears to be insignificant (F-statistic = 1.93, p-value = 0.1467). This finding still holds when the attitudinal variables are excluded from the regression model, which will briefly be presented later. Maybe a more sensitive measurement of education, e.g. in years of schooling, which is unavailable information in this data set, would have allowed for a more differentiated insight into education as a determinant of WTP.

The hypothesis about homeowners stating a higher WTA is only partially rejected, since the two-stage regression analysis undertaken shaped out that being a homeowner is not significantly associated with stating a higher WTA, but it does significantly decrease the estimated probability of stating a WTA of zero, ceteris paribus. This finding is nonetheless not sufficient to make a robust inference about the presence, absence or effect of the endowment effect in the process of stating a WTA or homeowners factoring in the possible depreciation of their property systematically into their stated WTA. It might be that this finding points at a frequent misunderstanding of the questionnaire, which is that only homeowners are warranted in stating a non-zero WTA. If a logit regression similar to the second one in Table 7 is executed with the dependent variable taking the value 1 not only for true zeros but also for protest zeros, then being a homeowner is highly significant (p-value $<$ 0.0001) and decreases the estimated probability of stating a true or protest zero WTA compared to not being a homeowner, ceteris paribus. An explanation via the

association between being a homeowner and the stated attitudes towards the WTA policy is unlikely since the relationship is rather weak (Cramer's V = 0.1443). If a similar model is run with the dependent variable taking the value 1 for all protest respondents (zero and non-zero) and 0 otherwise, then being a homeowner does not produce a significant estimated coefficient and therefore does not seem to be significantly associated with the decision of whether to state a protest or non-protest response. This in conjunction with some participants who stated a zero WTA stating a response along the lines "I live in a rental home." in the open text question at least strongly raises the suspicion that the WTA elicitation was frequently misunderstood. Some respondents possibly over-focused on the information that if they own a home the proximity to the wind turbine can cause a depreciation of up to five percent and did not understand that everyone was asked to value the expected negative externalities (noise pollution and visual impact) regardless of being a homeowner. The output tables of the additional models can be found in the Appendices in Table 11.

As outlined before, previous studies made seemingly contradicting findings about the relationship between WTP and household size or the number of children in the household. Due to the high correlation between these different variables about household composition only household size was included, and it is hypothesized that a bigger household is related to lower WTP. A logical yet easy explanation for this finding is the pressure on disposable income due to having (more) children, which was also suggested by Koundouri, Kountouris, and Remoundou (2009). The hypothesis is partially accepted since the association between household size and size of WTP is negative but only weakly significant (p-value = 0.054). Also, an additional household member increases the estimated probability to state a zero WTP, which is so to say the lowest possible WTP.

Higher household income appears to be predictive of a higher WTP and also of a higher WTA. Hence, high-income communities that (on average) have a high WTP for wind energy development in general might at the same time require high compensations if this wind energy development takes place in close proxmity to them. Additionally, the estimated two-stage regression yields findings that exceed

the scope of the hypotheses. While income appears to be significantly associated with the size of a participant's positive WTP or WTA, it does not seem to be significantly associated with the estimated probability to state a zero WTP[10] or zero WTA. Therefore, comparable to the findings of Liebe, Preisendörfer, and Meyerhoff (2011), it becomes apparent that the two decisions that are being modeled also have different determinants and that some prominent and often reported determinants of WTP like income (e.g. Wiser, 2007; Guo et al., 2014; Mozumder, Vásquez, and Marathe, 2011) are not determinants for the decision of whether or not to state a positive WTP (and WTA) at all, but only for the decision of the size of the WTP when it is decided that the WTP is greater than zero.

The role that gender plays regarding WTP appears twofold in this analysis. Female participants compared to male participants have a lower estimated probability to state a WTP of zero, ceteris paribus. However, when a positive WTP is stated then female participants on average state a lower WTP than male participants, all other things equal, which supports the hypothesis about gender. This result does not change when the models are estimated including a control variable for household position that takes the value 1 when participants state to be the head of the household and 0 otherwise.

Considering climate concern, this regression analysis suggests that being concerned about climate change compared to not being concerned is only associated with the decisions about WTP. This concern does not seem to be systematically related to the decisions about WTA, at least this cannot be robustly inferred from the regression results. Therefore, it seems like individuals who are concerned about climate change and global warming do have a higher WTP for increased wind energy provision and a lower estimated probability of stating a WTP of zero. The amount they find appropriate to compensate them for having a wind turbine erected close to their home, on the other hand, is not lower than for individuals who are not concerned about these matters, ceteris paribus. Even though a causal relationship cannot be claimed, an implication of these results could be that when an information

[10] This finding still holds when respondents who stated a WTP of zero due to "I cannot pay more" are considered real zeros and are included in the first logit regression.

Independent variable	Dependent variable	Result
WTP		
Higher income	Higher WTP	Accepted
Higher education	Higher WTP	Rejected
Being concerned about climate change	Higher WTP	Accepted
Positive attitude towards proposed policy	Higher WTP	Accepted
Being a homeowner	Higher WTP	Rejected
Living in a rural area	Higher WTP	Rejected
Gender (female)	Lower WTP	Accepted
Bigger household/family	Lower WTP	(partially) Accepted
Being full-time employed	Lower WTP	Rejected
WTA		
Being a homeowner	Higher WTA	(partially) Rejected
Being retired	Higher WTA	Rejected
Negative attitudes towards proposed policy	Higher WTA	Accepted
Positive attitudes towards proposed policy	Lower WTA	Rejected

Table 9: Hypotheses overview

set similar to the one used for the regressions is available to e.g. an energy provider, wide-spread concern about climate change in a community is in itself not an argument for it potentially being a superior site for wind turbine erection in terms of compensations. However, it seems to imply that in said community a larger share would be willing to financially contribute and willing to contribute higher amounts for wind energy development in general than in a community in which this concern is less prevalent.

Furthermore, the relationship between the attitudes towards the policies and the elicited valuations is generally consistent with the formulated hypotheses. It is noteworthy that, when the decisions about the size of the WTP and WTA are considered, in both models only one attitude variable produces a significant coefficient, while the other appears to be insignificant when compared to having no opinion towards the policies. Proponents of an increase of wind energy provision state a higher WTP than individuals who have no opinion about the policy. Opponents of the policy do not seem to state a significantly different WTP from the participants with no opinion on this topic. When WTA is considered this pattern is reversed. Opponents of the policy state a higher WTA than those who hold no opinion and proponents do not seem to state a WTA that is significantly different from those who hold no

opinion. An implication of this can be that a private firm or government entity that evaluates locations for the erection of wind turbines and will in some form deliberate with affected residents about compensations should devote more attention to identifying opponents than proponents, since proponents do not seem to initially ask for a lower compensation than indecisive individuals while opponents advocate for significantly higher compensations. Also, as will be presented in the next section that further investigates the role of attitudes, opponents of the WTA policy also do seem to state a significantly lower WTP for wind energy development in general than those who have no opinion or are in favor of the WTA policy, all other things equal.

6.1.1 Additional models: the role of attitudes

To further analyze the role that attitudes play additional models have been estimated that can be found in the Appendices. All four main regression models (Table 7 and Table 8) were estimated without attitudinal variables since these appear quite dominant in the regressions. Also, all four models were estimated with both sets of attitudinal variables included to evaluate if attitudes towards the WTP or WTA policy might add explanatory power in the models concerned with the respectively other measure. The two categorical variables with three categories each (no opinion, against, in favor) are moderately associated (Cramer's V = 0.3871).

When attitudinal variables are excluded the logit regressions (Table 12) significantly decline in explanatory power, with the McFadden's pseudo R^2 for example decreasing from 0.3702 to 0.0904 in the zero WTP model and from 0.0950 to 0.0582 in the zero WTA model, which partially confirms the dominance of the attitudinal variables. When compared to the main model it is interesting that it seems like living in an urban area is to a certain degree predictive of not being willing to pay for increased wind energy provision and also of requiring compensation for having a wind turbine erected in proximity to one's home.

The estimated coefficients of the OLS models excluding the attitudinal variables (Table 13) are quite comparable to the main model in the case of the model concerned with the size of the WTP. However, in the model concerned with the size of the

WTA age, living in an urban area and both dummies for educational attainment seem to be significantly associated with a higher WTA and being concerned about climate change with a lower stated WTA when attitudinal variables are excluded. These variables produced insignificant coefficients when attitudinal variables were included.

When all attitudinal variables (from the WTP and the WTA scenario) are included the estimated coefficients of the zero WTP model remain relatively unchanged and the attitudinal variables of the WTA scenario produce insignificant coefficients (Table 14). However, a noteworthy difference becomes visible in the zero WTA model: the dummy variable for being against the WTA is now only weakly significant, while being in favor of the WTP policy produces a highly significant negative coefficient. A possibly explanation is the high frequency of respondents who are in favor of the WTP policy of almost 75% of all respondents. The share of respondents who stated a zero WTA of these respondents is not higher than that of those who stated to have no opinion or were in favor of the WTA policy.

Including all attitudinal variables changes the estimated coefficients of the OLS regressions (Table 15) slightly, but not fundamentally. The most prominent change is that being against the WTA policy compared to having no opinion decreases the estimated WTP by 19 percent, ceteris paribus. An implication of this is that being specifically against the erection of wind mills close to residential areas is associated with also stating a lower WTP for increased wind energy provision in general, while the attitude about the increase in wind energy provision does not seem to be associated with a higher or lower compensation requirement for the disadvantages due to having a wind turbine erected close to one's home, ceteris paribus. The attitude towards the specific case is to a certain degree predictive for the valuation of the general case but not the other way around when size of WTP and WTA are considered.

6.2 Discussion of elicited WTP and WTA values

The mean monthly WTP is estimated to be €23.38 with 669 out of 719 valid WTP responses (93%) being greater than zero (extensive statistics are presented in Table

5). This amounts to a mean total WTP per household (twelve times the monthly mean WTP) of €280.56 per year. To put this number into perspective: the average Dutch household spends approximately €1,690 on energy in 2020 of which €620 are spent on electricity (Stichting Milieu Centraal, 2020). A rather tentative total valuation of the benefits of the proposed policy can be calculated under the assumption that there are approximately 7.9 million households in the Netherlands and that the mean WTP represents the mean value of the policy to a household. The total national valuation of the benefits of this policy that enables the provision of wind energy to one million extra households then is €2,216,424,000[11] or roughly €2,216 for each additional household that is provided with wind energy. It should be noted, that the outlined scenario did not mention any potential decrease in electricity costs once new wind energy capacities are installed.

The mean WTA stated by the participants of this study is €23,074[12]. It exceeds the realm of this study to to create realistic scenarios with a minimum and maximum number of onshore wind turbines that need to be erected to provide wind energy to an additional one million households as stated in the WTP scenario and define a lower and upper bound of the number of households that would be entitled to get compensation in these scenarios. Nonetheless, a simplified back-of-the-envelope calculation can be undertaken to judge if the WTP roughly equals construction and compensation costs of the necessary wind turbines for providing one million extra household with wind energy.

If three assumptions are made said calculation can be carried out: first, one onshore wind turbine produces energy for approximately 2,000 households on average (Ministerie van Economische Zaken, 2020). Second, the total costs of one wind turbines is approximately €3,000,000 (De Groene Rekenkamer, 2020). Third, the wind turbines will be erected close to residential areas, which leads to an average of 100 households within the 500 to 1,000 meter range from each turbine, who get compensation. Hence, 500 wind turbines need to be erected to provide wind energy

[11] If all protest responses are coded to represent a monthly WTP of zero then these statistics change to a mean monthly WTP of €18.83, a mean total WTP per household of €225.96 and a total valuation of €1,785,084,000.

[12] If protest respondents are included and coded to have stated a WTA of €50,000 then the mean WTA is €32,150.

for an additional one million households and for every turbine 100 households get a compensation of €23,074, which amounts to a total of €1,153,700,000 in compensation costs. Together with the total construction costs of the 500 turbines of €1,500,000,000 this amounts to 120 percent of the before presented total national WTP of €2,216,424,000. Despite this calculation relying on simplified, broad assumptions, it serves to show that under said assumptions the elicited WTP and WTA estimates do not imply that the increase of wind energy provision by means of onshore wind turbines close to residential areas is clearly infeasible when compensations are taken into account. Quite the contrary, it can be seen to encourage further research on the viability of such policies.

Additionally, the elicited valuations can be located within the existing body of CV studies in this realm. It is to be noted that any comparison of obtained valuations between separate CV studies is to be treated with caution, since the valued policies and their benefits/detriments that are being outlined are, at least considering all studies cited here, never congruent. Small changes in the design of the policies, like the proposed payment mechanism, or the elicitation formats can have significant effects on the elicited valuations (Carson, Flores, and Meade, 2001; Wiser, 2007).

The here elicited mean monthly WTP in nominal terms is among the highest elicited valuations of all studies that were presented before, regardless of whether protest responses are included to represent a WTP of zero. The only study that elicited a comparable valuation is Mozumder, Vásquez, and Marathe (2011) who elicited a mean monthly WTP of US$25 for raising the share of wind energy in the energy mix of New Mexico to 20%. However, no time horizon for this payment was defined in the survey as in most other presented studies (Zografakis et al., 2010; Wiser, 2007; Koundouri, Kountouris, and Remoundou, 2009; Bollino, 2009), which further complicates a comparison. When inflation is neglected then the here elicited mean total WTP of €280.56 is nominally equal to what the average participant of Zografakis et al. (2010) would be willing to pay over a period of roughly 51 months (in quarterly payments). Participants of Koundouri, Kountouris, and Remoundou (2009) would be willing to pay a nominally equal amount when their bimonthly WTP is paid over a period of 64 months. When the highest mean (bimonthly)

WTP estimate from Bollino (2009) is considered, then €280.56 would be paid after about 60 months and participants of Guo et al. (2014) stated a total WTP of US$198 over five years.

The elicited mean WTA by far exceeds the elicited mean WTA by Groothuis, Groothuis, and Whitehead (2008) of US$23 annually (indefinitely), which is a poor comparison due to the difference in proposed scenarios. This study posed having a wind turbine erected 500 to 1,000 meters from one's home, while the other study proposed siting wind turbines at four different locations in a rural county, which presumably causes less direct disadvantage to many households than a wind turbine "in the backyard". Due to WTP being the far more prevalent measure in this realm and a comparison between WTP and WTA estimates being hindered by the frequently documented WTP-WTA-disparity (Tunçel and Hammitt, 2014), the further comparison with stated preference studies seems of limited value. Revealed preference studies such as Gibbons (2015) estimated that a household in Ireland would be willing to pay around £600 annually, which is equal to about €670 as of November 2020, to avoid having a small wind farm build within two kilometers from their home and the life satisfaction approach study of Krekel and Zerrahn (2017) estimated that a compensation of €258 annually per household balances out the permanent disadvantages to citizens due to having a wind turbine located up to four kilometers from their home in Germany. Again, these are permanent cash flows. If inflation is neglected, the estimated annual payment of Gibbons (2015) (whose scenario seems more comparable to the one in this study than the one by Krekel and Zerrahn (2017)) would nominally equal the WTA estimated in this study (€23,074) after 35 years. Despite many obstacles to a robust comparison and conceptual differences of the research approaches, it does not seem unrealistic that the amount a household should get to be forever compensated for having a wind turbine erected very close to their home is equal to an amount they would be expected to pay over 35 years to avoid the wind turbine altogether.

Lastly, it can be noted that there is usually a hypothetical bias involved when individuals try to assess their WTP or WTA in CV studies: stated WTP is for example usually larger than actual WTP. Murphy et al. (2005) conducted a meta

study of papers that explore the difference between stated WTP and actual WTP for the same good[13]. The mean calibration factor they find is 2.6, and 1.54 when outliers are excluded, which is close to the ratio of 1.71 that Champ and Bishop (2001) found between stated and actual WTP in their study concerning the WTP for wind energy. The mean monthly WTP elicited in this study of €23.38 then decreases to €15.18 when corrected with a calibration factor of 1.54. The mean monthly WTP including protest responses of €18.83 analogously decreases to €12.23. These values might be a better estimation of what Dutch citizens would be willing to pay for realizing a policy as outlined in the survey in practice.

7 Limitations

It must be acknowledged that this research endeavor has several limitations that are either inherent to the stated preference approach and the CV method or are specific to this data set. These will be outlined in the following before concluding remarks are formulated.

The quality of especially the elicited WTA values is likely to suffer from two problems. First, the identification of protest responses might be incomplete since these were only identified when a valuation of zero or a valuation that exceeded the scale was documented. However, the answers respondents gave in the open text question to explain their valuation in some cases raised the suspicion that even seemingly "valid" responses were meant to express protest. One respondent stated a WTA of €40,000 and indicated that she does not want wind turbines close to residential areas and that €40,000 is probably not feasible for the government, which can implicitly be understood to express protest against the policy. Second, several participants indicated that the WTA scenario does not apply to them since they do not own a home, which hints at several participants that did not understand what was asked from them. These respondents seemed to be likely to state a WTA of zero and this comprehension problem also seems to be partially reflected in the regression analysis outlined before.

[13] Due to a paucity of studies concerned with stated and actual WTA the authors could not research hypothetical bias in that realm.

A case can also be made for an omitted variable bias in the regression model explaining the size of WTA. Participants were asked to consider an up to five percent depreciation of their real estate property when stating a WTA. Therefore, property values are likely to be a determinant of the WTA. Additionally, property value is likely to be correlated to the net household income. Reliable data on property values and therefore private wealth is difficult to obtain and it was controlled for owning one's home. Nonetheless, the suspicion remains that an omitted variable bias is present. This is one of the reasons why a causal interpretation of the analyzed associations cannot be claimed.

Also, meta-studies such as Tunçel and Hammitt (2014) and Horowitz and McConnell (2002) document and analyze the WTP-WTA-disparity: if the WTP to acquire a good is compared to the WTA to forgo it, the elicited WTA often far exceeds the elicited WTP. The elicited WTA and WTP values in this study do not correspond to the acquisition or waiver of the same good, but it should be noted that a variety of factors seem to obscure a comparison between WTP and WTA estimates when putting the two elicited measures in relation to each other (Venkatachalam, 2004). Some authors such as Arrow et al. (1993) suggest eliciting WTP even when WTA is conceptually more applicable since it is deemed the more conservative measure. This in addition to the large share of protest respondents and the suspicion about comprehension problems in the WTA elicitation might be a weakness of the comparison of WTP and WTA in this study. It appears gainful to devote a future stated preference study to eliciting a valuation of forgoing the disadvantages from having a wind turbine erected close to one's home in a WTP format as in other stated preference studies such as Mirasgedis et al. (2014), Ladenburg and Dubgaard (2007), and Krueger, Parsons, and Firestone (2011) and incorporate information on property values. This might enable a better comparison of the stated valuations of benefits and disadvantages arising from such policies.

It also seems evident that WTP and WTA estimates are highly sensitive to different design factors of CV questionnaires. Quite arbitrary, quantitative anchors can for example affect the estimates (Simonson and Drolet, 2004). In the descriptions of the WTP and WTA scenario a few numbers were mentioned that could have

served as anchors for participants such as taking into account an up to five percent depreciation of their real estate if they were homeowners in the WTA scenario. The elicited valuations themselves, however, do not seem to have worked as anchors for each other, since the inclusion of WTP or WTA as an explanatory variable in the regression models produces highly insignificant coefficients. This is closely related to the topic of range bias. It can be assumed that range bias in some form has been introduced by the chosen payment scales (Soeteman, van Exel, and Bobinac, 2017; Whynes, Wolstenholme, and Frew, 2004). The centering of the distribution of WTA responses around the starting-, mid- and end-point of the scale might hint at a large share of respondents who did not have well-formed preferences and went for the "easy cue" as Soeteman, van Exel, and Bobinac (2017) also hypothesized. Nonetheless, even if "[...] optimal PS design for every specific CV context may remain unattainable [...]" (Soeteman, van Exel, and Bobinac, 2017, p. 751), all alternative elicitation methods also evidently have shortcomings (as outlined in the Background section) and the likely existence of a range bias does not invalidate the choice of elicitation method. Also, the applied two-stage PS format allows participants to give an open-ended response within the range they set for themselves in the first step, which may mitigate the impact of range bias since not only the explicitly presented values can be selected. Additionally, studies such as Pouta (2004) suggest that the responses to the valuation questions in CV questionnaires may be sensitive to the inclusion of attitudinal questions before the valuation questions, as it was the case in the questionnaire used in this study.

An additional limitation that has briefly been described in the Discussion section is the hypothetical nature of CV studies. Elicited hypothetical WTP values appear to overstate actual WTP in most cases and similar observations were made about hypothetical and actual WTA (Murphy et al., 2005; List and Gallet, 2001). Also, there seems to be no consensus on what factors of the design of CV surveys can reliably be expected to induce greater or lesser hypothetical bias. Therefore, no well-founded, survey-specific expectation on the size of the hypothetical bias in the elicited WTP and WTA values can be formed. These are some of the limitations that underline how cautiously elicited values from CV studies and results of their

analysis must be treated.

Nonetheless, a variety of factors strengthen the confidence in the results of this study, even though numerous limitations are apparent. The sample data set that consists of the responses of LISS panel members can be considered representative for the Dutch population and not just Dutch internet users since it "[...] combines the scientific standards for a longitudinal panel with the advantages of Internet interviewing as a method of data collection." (Scherpenzeel, 2011, p. 56) and devotes special attention to including non-internet households and elderly citizens, which are frequently underrepresented in online surveys, by providing easy-to-use computers for these groups (Scherpenzeel, 2011). Additionally, the WTP and WTA elicitation by means of the (in this realm comparatively novel) two-stage PS format seems to have produced realistic valuation estimates that are generally consistent not only with other stated preference studies' results, but also the results of revealed preference studies. Furthermore, the two-stage regression analyses produced results that are largely in accordance with before-formulated hypotheses and expectations about the determinants of the elicited WTP and WTA values. Finally, valuing the advantages and then potentially borne disadvantages due to a renewable energy policy allowed participants and this study to consider two sides of the same coin. This enabled a more holistic assessment and analysis then only eliciting a valuation for one of the two, as frequently done, and reflects the complex weighing-off process inherent to considerations of renewable energy policies better.

8 Conclusion

The first aim of this study was to provided estimates of the valuation of the benefits due to increasing wind power provision to one million additional Dutch households and the disadvantages of having a wind turbine placed in close proximity to one's home. The elicited valuations can be used to inform policymakers about the public perception and the magnitude of benefits and disadvantages, which must frequently be weighed-off against each other in the planning of and discussion about investments into wind energy development. Overall, the elicited values are pointing at

high acceptance and WTP for increased wind energy provision and also at the viability of increasing the energy transport efficiency by placing wind turbines close to residential areas at the cost of compensating negatively affected residents. Nonetheless, it is apparent that the more general WTP scenario sparks less controversy, which can be seen as a clue pointing at the existence of NIMBY sentiments.

The second aim of this study was to provide a differentiated analysis of the determinants of in-principle WTP and WTA and the size of the WTP and WTA. It was shown that the in-principle decisions compared to the decisions about the size of the valuations as well as the decisions regarding the WTP compared to those regarding the WTA have different determinants. These results can aid government entities and private enterprises in the understanding of choice behavior and the identification of communities that are likely to display certain behavior with regard to the economic evaluation of the benefits and disadvantages of wind energy and, hence, adapt their strategy about, for example, where to propose and advocate the siting of new wind turbines accordingly.

Finally, additional research is necessary to gain a reliable indication of how predictive these hypothetical valuations are for an actual market scenario since studies such as Champ and Bishop (2001) suggest that not just the elicited values are different when hypothetical compared to actual payments are considered, but also partially their determinants. Therefore, the final remark of this study must be that revealed preference studies based on, for example, pilot communities that deliberate about the actual realization of such policies are ultimately necessary to judge the external validity of the WTP and WTA elicitation and the analysis of their determinants presented here.

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Appendices

Valuation questions

Willingness to pay

q34

Een van de mogelijkheden om meer groene energie te realiseren is het bouwen van windmolens. Op het moment gebruiken ongeveer twee miljoen huishoudens in Nederland groene energie van windmolens.

Stel dat de overheid zou willen investeren in windmolens om één miljoen extra huishoudens in Nederland groene energie te laten gebruiken. Wat vindt u hiervan?

1. Ben ik sterk voor
2. Ben ik voor
3. Ben ik tegen
4. Ben ik sterk tegen
5. Geen mening

Deze schaal werd horizontaal weergegeven

q35

Stel dat de overheid deze windmolens wil betalen door een belastingverhoging die door alle belastingplichtigen in Nederland moet worden betaald. Deze belastingverhoging is voor de duur van **één jaar** en moet **maandelijks betaald** worden.

Bekijk onderstaande bedragen, beginnend vanaf **links**, en kies het **hoogste bedrag** dat u **zeker wel** per maand extra aan belasting zou willen betalen voor het bouwen van windmolens. Houd hierbij rekening met het netto maandelijkse inkomen en eventueel spaargeld van uw huishouden. Als u geen belasting betaalt, stel u dan voor wat u zou willen betalen als u wel belasting zou betalen.

1. €0
2. €5
3. €10
4. €15
5. €20
6. €25

7. €30
8. €40
9. €50
10. €75
11. €100
12. meer

if q35 = 1
q36a
U hebt aangegeven dat u €0 wilt betalen voor het bouwen van de windmolens door de overheid. Kunt u aangeven wat de belangrijkste reden is?

1. Het is mij niet meer dan €0 waard
2. Ik kan niet meer dan €0 betalen
3. De overheid moet hiervoor betalen
4. Anders

if q35 = 12
q36b
U hebt aangegeven dat u meer dan €100 per maand extra aan belasting wilt betalen voor het bouwen van windmolens door de overheid om één miljoen extra huishoudens van groene energie gebruik te laten maken. Wat is het **maximale bedrag** dat u hiervoor zou willen betalen? Houd hierbij rekening met het netto maandelijkse inkomen en eventueel spaargeld van uw huishouden. *integer* euro

if q35 > 1 and q35 < 12
Deze schaal werd horizontaal weergegeven
q36c
Bekijk nogmaals onderstaande bedragen, beginnend vanaf **rechts**, en kies het **laagste bedrag** dat u **zeker niet** per maand extra aan belasting zou willen betalen voor het bouwen van windmolens. Houd hierbij rekening met het netto maandelijkse inkomen en eventueel spaargeld van uw huishouden.

1. €0
2. €5
3. €10
4. €15
5. €20

6. €25
7. €30
8. €40
9. €50
10. €75
11. €100
12. meer

if q35 > 1 and q35 < 12
q37
U hebt aangegeven dat u in ieder geval [q35] extra belasting wilt betalen voor het bouwen van de windmolens, maar niet meer dan [q36c]. Welk **bedrag tussen [q35] en [q36c]** komt het **dichtste bij het maximale bedrag** dat u per maand extra aan belasting zou willen betalen voor het bouwen van de windmolens? Houd hierbij rekening met het netto maandelijkse inkomen en eventueel spaargeld van uw huishouden. *integer* euro

Willingness to accept

q40
Windmolens kunnen op verschillende locaties gebouwd worden, los van elkaar of ingroepen.

Stel dat de overheid de windmolens in de buurt van de gebruikers van groene energie zou willen bouwen, omdat dan de minste energie verloren gaat bij het transport van de energie naar de gebruiker. In plaats van op grote windmolenparken, komen windmolens dan in de buurt, (op 500 tot 1.000 meter afstand) van woonwijken te staan. Wat vindt u hiervan?

1. Ben ik sterk voor
2. Ben ik voor
3. Ben ik tegen
4. Ben ik sterk tegen
5. Geen mening

Deze schaal werd horizontaal weergegeven
q41

Stel dat de overheid een windmolen in de buurt van uw woning zou willen bouwen, op 500 tot 1.000 meter afstand. Het is bekend dat windmolens geluidsoverlast kunnen veroorzaken en dat sommige mensen het uitzicht op een windmolen niet mooi vinden. Een windmolen in de buurt van uw woning kan daarom een negatieve invloed hebben op uw woongenot. Als u eigenaar bent van de woning, kan het ook leiden tot een waardevermindering van uw woning tot maximaal 5%. De overheid zou u een vergoeding kunnen geven voor deze gevolgen.

Bekijk onderstaande bedragen, beginnen vanaf **links**, en kies het **hoogste bedrag** dat u **zeker niet** als eenmalige vergoeding zou accepteren voor het bouwen van een windmolen in de buurt van uw woning, omdat u deze vergoeding **te laag** vindt. Houd hierbij rekening met de mogelijke gevolgen die hierboven genoemd zijn.

1. €0
2. €5,000
3. €10,000
4. €15,000
5. €20,000
6. €25,000
7. €30,000
8. €40,000
9. €50,000

if q41 = 1
q42a
U hebt aangegeven dat u €0 als vergoeding wilt accepteren voor het bouwen van een windmolen in de buurt van uw woning. Kunt u aangeven wat de belangrijkste reden is?

1. Ik heb geen bezwaar tegen een windmolen in de buurt van mijn woning
2. Ik verwacht geen effecten van een windmolen op 500 tot 1.000 meter van mijn woning
3. Ik ben het niet eens met het betalen van compensatie
4. Anders

if q41 = 9
q42b
U hebt aangegeven dat u €50.000 niet voldoende vindt als vergoeding voor het bouwen van een windmolen in de buurt van uw woning. Wat is het **minimale**

bedrag dat u als vergoeding zou accepteren? Houd hierbij rekening met de gevolgen die hiervoor genoemd zijn.

integer euro, *empty*

if q41 = 9
Deze vraag werd op dezelfde pagina weergegeven als q42b
q42b_geen
Geen bedrag is genoeg om de effecten te vergoeden.
Nee
Ja
empty

if q41 > 1 and q41 < 9
Deze schaal werd horizontaal weergegeven
q42c
Bekijk nogmaals onderstaande bedragen, beginnend vanaf **rechts**, en kies het **laagste bedrag** dat u **zeker wel** accepteren als vergoeding voor het plaatsen van een windmolen in de buurt van uw woning. Houd hierbij rekening met de mogelijke gevolgen die hiervoor genoemd zijn.

1. €0
2. €5,000
3. €10,000
4. €15,000
5. €20,000
6. €25,000
7. €30,000
8. €40,000
9. €50,000

if q41 > 1 and q41 < 9
q43
U hebt aangegeven dat u [q42c] in ieder geval wel als vergoeding zou accepteren voor het bouwen van een windmolen in de buurt van uw woning, maar [q41] zeker niet. Welk **bedrag tussen [q41] en [q42c]** komt het **dichtste bij het minimale bedrag** dat u zou accepteren als eenmalige vergoeding door de overheid voor het bouwen van een windmolen op 500-1.000 meter van uw woning? Houd hierbij rekening met de mogelijke gevolgen die hiervoor genoemd zijn.

integer euro

Additional regression outputs

	zeroWTP[a]			zeroWTA[b]		
VARIABLES	Coefficient	SE	P-Value	Coefficient	SE	P-Value
Log(net household income)	-0.74***	(0.22)	0.00	0.12	(0.33)	0.72
Age	0.00	(0.01)	0.57	0.00	(0.01)	0.75
Urban (1=yes)	-0.52**	(0.22)	0.02	-0.43	(0.33)	0.19
Gender (1=female)	-0.62***	(0.22)	0.01	-0.51*	(0.29)	0.08
No. of household members	0.27**	(0.11)	0.01	-0.09	(0.14)	0.54
Education[c]						
Medium education	-0.00	(0.28)	0.99	0.08	(0.36)	0.82
High education	-0.15	(0.29)	0.60	-0.50	(0.45)	0.26
Own home (1=yes)	-0.27	(0.26)	0.31	-0.82**	(0.32)	0.01
Occupation[d]						
Employed	-0.17	(0.28)	0.54	-0.20	(0.37)	0.58
Retired	0.27	(0.36)	0.44	-0.44	(0.51)	0.39
Concerned climate (1=yes)	-0.55**	(0.23)	0.02	-0.06	(0.31)	0.86
Attitude WTP[e]						
In favor	-2.05***	(0.27)	0.00			
Against	0.92***	(0.35)	0.01			
Attitude WTA[f]						
In favor				0.28	(0.37)	0.46
Against				-1.55***	(0.47)	0.00
Constant	5.95***	(1.63)	0.00	-1.76	(2.40)	0.46
Observations	761			761		
(McFadden's) Pseudo R^2	0.251			0.121		
Adjusted Count R^2	0.259			0.000		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[a] Dependent variable takes the value 1 for all true zeros and protest responses.
[b] Dependent variable takes the value 0 for all non-zero WTA responses including all protest responses.
[c] Reference category is the lowest education category. *Medium education* encompasses MBO and HAVO/VMBO degree holders and *High education* WO and HBO degree holders.
[d] Reference category are unretired participants who are not employed.
[e] Reference category is stating to be have "No opinion".
[f] Reference category is stating to be have "No opinion".

Table 10: Estimation results of logit regression models including protest responses as a robustness check

VARIABLES	zeroWTA[a] Coefficient	SE	P-Value	protestWTA[b] Coefficient	SE	P-Value
Log(net household income)	-0.10	(0.23)	0.65	-0.30	(0.22)	0.16
Age	0.01	(0.01)	0.23	0.02***	(0.01)	0.01
Urban (1=yes)	-0.21	(0.21)	0.32	-0.10	(0.18)	0.57
Gender (1=female)	0.06	(0.20)	0.77	0.34*	(0.18)	0.06
No. of household members	0.04	(0.10)	0.68	0.11	(0.09)	0.21
Education[c]						
Medium education	0.23	(0.26)	0.37	-0.00	(0.23)	0.99
High education	-0.19	(0.28)	0.51	0.16	(0.24)	0.50
Own home (1=yes)	-0.87***	(0.24)	0.00	-0.24	(0.23)	0.29
Occupation[d]						
Employed	-0.16	(0.27)	0.56	-0.14	(0.23)	0.55
Retired	0.35	(0.32)	0.28	0.13	(0.28)	0.63
Concerned climate (1=yes)	-0.31	(0.21)	0.13	-0.32*	(0.18)	0.08
Attitude WTA[e]						
In favor	-0.48*	(0.28)	0.09	-1.11***	(0.29)	0.00
Against	-0.27	(0.27)	0.32	0.72***	(0.24)	0.00
Constant	0.15	(1.66)	0.93	0.37	(1.54)	0.81
Observations	620			761		
(McFadden's) Pseudo R^2	0.0569			0.128		
Adjusted Count R^2	0.000			0.051		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[a] Dependent variable takes the value 1 for all WTA protest zeros and true zeros.
[b] Dependent variable takes the value 1 for all WTA protest responses.
[c] Reference category is the lowest education category. *Medium education* encompasses MBO and HAVO/VMBO degree holders and *High education* WO and HBO degree holders.
[d] Reference category are unretired participants who are not employed.
[e] Reference category is stating to be "Strongly against it". Exact phrasing of the question can be inferred from Table 3.

Table 11: Estimation results of logit regression to investigate comprehension problem among non-homeowners

VARIABLES	zeroWTP Coefficient	SE	P-Value	zeroWTA Coefficient	SE	P-Value
Log(net household income)	0.01	(0.37)	0.97	0.07	(0.34)	0.84
Age	0.01	(0.01)	0.48	0.00	(0.01)	0.72
Urban (1=yes)	0.70*	(0.39)	0.07	-0.57*	(0.34)	0.10
Gender (1=female)	-0.74**	(0.34)	0.03	-0.50*	(0.29)	0.09
No. of household members	0.19	(0.16)	0.23	-0.04	(0.14)	0.79
Education[a]						
Medium education	-0.11	(0.47)	0.82	0.10	(0.36)	0.79
High education	-0.06	(0.49)	0.90	-0.47	(0.45)	0.30
Own home	-0.33	(0.41)	0.41	-1.10***	(0.34)	0.00
Occupation[b]						
Employed	-0.13	(0.51)	0.81	-0.35	(0.37)	0.34
Retired	0.47	(0.64)	0.46	-0.50	(0.51)	0.33
Concerned climate (1=yes)	-1.34***	(0.45)	0.00	-0.08	(0.31)	0.79
Constant	-3.26	(2.69)	0.22	-1.10	(2.44)	0.65
Observations	639			526		
(McFadden's) Pseudo R^2	0.0904			0.0582		
Adjusted Count R^2	0.000			0.000		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[a] Reference category is the lowest education category. *Medium education* encompasses MBO and HAVO/VMBO degree holders and *High education* WO and HBO degree holders.
[b] Reference category are unretired participants who are not employed.

Table 12: Estimation results of logit regression models **without attitudinal variables**

VARIABLES	Log(WTP) Coefficient	SE	P-Value	Log(WTA) Coefficient	SE	P-Value
Log(net household income)	0.28***	(0.07)	0.00	0.15**	(0.06)	0.02
Age	-0.00	(0.00)	0.19	0.00*	(0.00)	0.08
Urban (1=yes)	0.08	(0.06)	0.19	0.11**	(0.05)	0.04
Gender (1=female)	-0.15**	(0.06)	0.01	0.06	(0.06)	0.32
No. of household members	-0.05*	(0.03)	0.09	0.01	(0.02)	0.59
Education[a]						
Medium education	-0.06	(0.08)	0.47	0.14*	(0.08)	0.07
High education	0.10	(0.08)	0.24	0.14*	(0.08)	0.09
Own home	0.05	(0.07)	0.46	0.11	(0.07)	0.12
Occupation[b]						
Employed	-0.05	(0.07)	0.46	0.10	(0.08)	0.18
Retired	-0.01	(0.10)	0.92	-0.03	(0.10)	0.76
Concerned climate (1=yes)	0.21***	(0.06)	0.00	-0.11**	(0.05)	0.04
Constant	0.90*	(0.49)	0.06	8.33***	(0.48)	0.00
Observations	599			472		
R^2	0.094			0.077		
Adjusted R^2	0.077			0.055		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[a] Reference category is the lowest education category. *Medium education* encompasses MBO and HAVO/VMBO degree holders and *High education* WO and HBO degree holders.
[b] Reference category are unretired participants who are not employed.

Table 13: Estimation results of OLS regression models **without attitudinal variables**

	zeroWTP			zeroWTA		
VARIABLES	Coefficient	SE	P-Value	Coefficient	SE	P-Value
Log(net household income)	-0.05	(0.51)	0.92	0.07	(0.37)	0.85
Age	0.01	(0.01)	0.50	0.01	(0.01)	0.49
Urban (1=yes)	0.50	(0.46)	0.27	-0.47	(0.35)	0.18
Gender (1=female)	-1.02**	(0.42)	0.01	-0.55*	(0.30)	0.07
No. of household members	0.36**	(0.18)	0.05	-0.03	(0.15)	0.86
Education[a]						
Medium education	-0.05	(0.69)	0.94	0.12	(0.40)	0.76
High education	0.07	(0.64)	0.91	-0.29	(0.49)	0.54
Own home	-0.64	(0.54)	0.24	-0.87**	(0.35)	0.01
Occupation[b]						
Employed	-0.49	(0.63)	0.43	-0.34	(0.39)	0.39
Retired	-0.19	(0.77)	0.81	-0.39	(0.53)	0.47
Concerned climate (1=yes)	-0.97*	(0.50)	0.05	-0.10	(0.32)	0.76
Attitude WTP[c]						
In favor	-2.25***	(0.65)	0.00	-1.46***	(0.51)	0.00
Against	1.44**	(0.59)	0.02	-1.58	(1.08)	0.14
Attitude WTA[d]						
In favor	-0.64	(1.00)	0.52	0.58	(0.51)	0.26
Against	0.14	(0.70)	0.85	-0.94*	(0.55)	0.08
Constant	-1.47	(3.90)	0.71	-0.39	(2.61)	0.88
Observations	639			526		
(McFadden's) Pseudo R^2	0.375			0.117		
Adjusted Count R^2	0.050			0.019		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[a] Reference category is the lowest education category. *Medium education* encompasses MBO and HAVO/VMBO degree holders and *High education* WO and HBO degree holders.
[b] Reference category are unretired participants who are not employed.
[c] Reference category is stating to have "No opinion".
[d] Reference category is stating to have "No opinion".

Table 14: Estimation results of logit regression models **including all attitudinal variables**

VARIABLES	Log(WTP) Coefficient	SE	P-Value	Log(WTA) Coefficient	SE	P-Value
Log(net household income)	0.28***	(0.06)	0.00	0.16***	(0.06)	0.01
Age	-0.00	(0.00)	0.36	0.00	(0.00)	0.20
Urban (1=yes)	0.09	(0.06)	0.12	0.08	(0.05)	0.12
Gender (1=female)	-0.11*	(0.06)	0.07	0.04	(0.06)	0.47
No. of household members	-0.06*	(0.03)	0.07	0.01	(0.02)	0.76
Education[a]						
Medium education	-0.07	(0.08)	0.34	0.14*	(0.08)	0.07
High education	0.08	(0.08)	0.34	0.12	(0.08)	0.12
Own home	0.07	(0.07)	0.27	0.07	(0.07)	0.33
Occupation[b]						
Employed	-0.02	(0.07)	0.74	0.07	(0.07)	0.34
Retired	0.01	(0.10)	0.94	-0.07	(0.10)	0.48
Concerned climate (1=yes)	0.18***	(0.06)	0.00	-0.08	(0.05)	0.15
Attitude WTP[c]						
In favor	0.37***	(0.11)	0.00	-0.02	(0.11)	0.83
Against	0.11	(0.18)	0.53	0.07	(0.13)	0.61
Attitude WTA[d]						
In favor	0.03	(0.10)	0.79	-0.09	(0.09)	0.31
Against	-0.19**	(0.09)	0.04	0.25***	(0.09)	0.00
Constant	0.58	(0.48)	0.23	8.28***	(0.47)	0.00
Observations	599			472		
R^2	0.140			0.148		
Adjusted R^2	0.118			0.120		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[a] Reference category is the lowest education category. *Medium education* encompasses MBO and HAVO/VMBO degree holders and *High education* WO and HBO degree holders.
[b] Reference category are unretired participants who are not employed.
[c] Reference category is stating to have "No opinion".
[d] Reference category is stating to have "No opinion".

Table 15: Estimation results of OLS regression models **including all attitudinal variables**